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Distinguishing Social Anxiety from Paranoia Testing the Aetiological Role

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Distinguishing Social Anxiety from Paranoia:
Testing the Aetiological Role of
Interpretative Biases

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Abstract

This thesis investigates the relationship between interpretation biases, social anxiety and paranoia. The overarching hypothesis is that differences in the manner of interpretation of emotionally ambiguous information may determine the type of symptoms which predominate, perhaps even which pathology emerges. For example, an interpretation which assumes an intent of harm (e.g. seeing two people whispering while looking at you means 'they are plotting against me') is likely to precipitate negative paranoid thoughts, perhaps ultimately persecutory delusions. In contrast, an interpretation of the same ambiguity, but which assumes the self is being negatively evaluated by others (e.g. seeing two people whispering while looking at you means 'they are talking about my faults') is likely to precipitate socially anxious thoughts and perhaps ultimately social anxiety disorder.

Experiment 1 (n=84) examined the form and strength of the associations between the hypothesised different types of interpretation bias (socially anxious resolutions/paranoid resolutions) and the traits of social anxiety versus paranoia. The results showed that there was a significant association between different types of interpretation bias and its content specific emotion trait. The negatively evaluated (socially anxious resolutions) interpretation bias was more strongly associated with social anxiety than the persecutory (paranoid resolutions) interpretation bias. Conversely, the persecutory (paranoid resolutions) interpretation bias was more strongly associated with paranoia than the negatively evaluated (socially anxious resolutions) interpretation bias.

Experiment 2 (n= 80) extended Experiment 1 by altering the task design to directly contrast paranoid and socially anxious interpretations (rather than contrasting paranoid versus non paranoid and, separately, socially anxious versus non-socially anxious). Under this forced-choice experimental design, the results revealed that there was a significant association between persecutory interpretation and its content specific emotion (paranoia). However, both types (negatively evaluated and persecutory) of interpretation bias were significantly associated with social anxiety.

Experiment 3 (n = 71) was a longitudinal follow up study (for which Experiment 1 served as the baseline). This study tested whether content specific interpretation biases would predict corresponding traits six months later, as an indirect test of the causal role of interpretation biases in precipitating social anxiety and paranoia. The results showed that negatively evaluated interpretation bias predicted subsequent social anxiety traits, and likewise persecutory interpretations predicted subsequent paranoia traits. Moreover, there was an interaction effect between the two types of bias suggesting that the predictive power of paranoid interpretation bias was especially strong when coexisting with a strong socially negative interpretation bias, which lends support to some theories of clinical paranoia.

Experiment 4 used a combination of existing and new data collected over a six-month period to test the hypothesis of reciprocal causality (do traits contribute to the exacerbation of congruent biases in addition to biases maintaining traits, such that a vicious cycle is established?). The data showed a reciprocal causality of the trait social anxiety in corresponding negatively evaluative interpretation bias, while there was an absent contribution of the trait paranoia to persecutory interpretation bias, which was instead due to the trait social anxiety.

Experiment 5 recruited a large clinical sample plus healthy controls (n= 102) to examine similar questions to those tested in the previous subclinical samples. The results revealed a

pattern broadly consistent with the content specific interpretation biases in both social anxiety and paranoid psychosis patients.

Findings of this thesis confirm the cognitive theories of psychopathology in social anxiety and early psychosis. The study demonstrates a reciprocal causality between social anxiety and both persecutory and negatively evaluated interpretation bias. It has confirmed the vicious circle proposed by cognitive theories of social anxiety, and suggested a mechanism for the maintenance of persecutory interpretation bias in paranoia. Although content-specific interpretation bias was weighted the most in the prediction of its corresponding trait characteristics, the effects from the content-unmatched interpretation bias could not be neglected. This finding extends previous observations using similar methods in subclinical samples, and suggests an aetiological pattern that goes beyond the notion of content specificity.

Declaration

I confirm that this thesis is my own work, and the use of all materials from other sources has been fully acknowledged. I have developed social anxiety related items of the Scrambled Sentences Task used in Experiments 1, 2, 3, 4, and 5, based on the work of Wenzlaff and Bates (1998). Paranoia related items of the Scrambled Sentences Task used in Experiments 1, 2, 3, 4, and 5 have been adapted by me, based on the work of Dr George Savulich. I have developed social anxiety related items of the Similarity Ratings Task used in Experiments 1, 2, 3, 4, and 5, based on the work of Eysenck and colleagues (1991). Paranoia related items of the Similarity Ratings Task used in Experiment 1, 2, 3, 4, and 5 have been adapted by me, based on the work of Dr George Savulich. Social anxiety related items of the word-sentence association paradigm used in Experiments 1, 3, 4, and 5 have been adapted by me, based on the work of Beard and Amir (2010). I have developed paranoia related items of the Scrambled Sentences Task used in Experiments 1, 2, 3, 4, and 5, based on the work of Beard and Amir (2010). Items of the Relatedness Judgment Task have been developed by me, based on the work of Savulich and Yiend (2012). I collected the data used in Experiments 1, 3, and 4. The data used in Experiment 2 was collected with assistance from MSc students Dana Jammal and Öykü Damla Irez. The data used in Experiment 5 was collected with assistance from MSc students Ulrika Evermann and Oluwadolapo Adegboye, and my colleagues Debbie Spains, and Freya Rumball.

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Chapter 1 Introduction

1.1 Cognitive Vulnerability to Psychopathology

Research on emotional and psychotic disorders has identified various cognitive factors associated with such conditions. Some ask whether identifying cognitive vulnerability might help predict mental health disorders (Casey et al., 2013; Fiszdon & Reddy, 2012; Garety & Freeman, 1999; Mathews & MacLeod, 2005) – identifying vulnerable individuals by their defective cognitive processing manners, for example, and aiming to reduce their presenting subclinical symptoms before they develop psychosis (McGorry et al., 2002; Morrison et al., 2004).

Cognitive vulnerability refers to defective beliefs or information processing biases developed long before the patient presents with a mental health problem (Riskind & Black, 2005). It is proposed as a predictor of disorder onset, and an accumulation factor for preventive intervention (Sarfati & Hardy-Bayle, 2002). Cognitive vulnerability ranges from basic information process dysfunction, including biased attention, interpretation, reasoning and memory, to associated cognitive consequences, such as emotional reactions, negative beliefs and anomalous experiences (e.g., Yiend, 2004; MacLeod & Rutherford, 2004). Cognitive vulnerability is present on a continuum in all populations, including both subclinical and clinical individuals (Gibb et al., 2004).

“Disorder-congruent” information processing bias has been proposed as the core characteristic of cognitive vulnerability (Beck & Clark, 1997; Riskind & Black, 2005). The content of cognitive vulnerability and the ways in which it is engaged reflect the disorder-dominated mood and beliefs of the individual. Interactions among mood and beliefs contribute to the development and maintenance of psychopathology (Williams et al., 1988; Beck & Clark, 1997). Blanchette and Richards (2010) recently clarified four key emotional cognitive domains associated with emotional disorders: interpretation, judgement, decision-making and reasoning. Savulich, Shergill and Yiend (2017) considered attention, reasoning and interpretation the most aetiologically significant cognitive processes in psychotic

disorders. For example, anxiety could lead to selective attention to threatening over neutral facial expressions (Gutierrez-Garcia & Calvo, 2014; Yiend et al., 2015). Patients with psychotic delusions responded more quickly and with reduced attention to threatening facial features (Moritz & Laund, 2007; Miskovic & Schmidt 2010). Stages of processes and content differ in different cognitive processes and mental health disorders (Riskind & Alloy, 2006).

1.1.1 Cognitive Vulnerability in Social Anxiety and Psychosis

Cognitive vulnerability is positively associated with different dimensions of symptomatology. For example, negative and interpersonally sensitive beliefs of ambiguity are associated with social anxiety (Amin et al., 1998, 1998; Constans et al., 1999; Voncken et al., 2003), while threatening and self-referent interpretations of ambiguity are associated with psychosis (Zimmerman et al., 1986), especially paranoid psychosis (Savulich et al., 2015 2015; Bentall & Kaney, 1996). Almost two-thirds of individuals with paranoia have a threatening interpretation style (Birchwood, 1999; Startup et al., 2015). Evidence suggests that specific cognitive content might contribute to specific disorders (Butler & Mathews, 1983; Williams et al., 1988). The relative contribution of psychotherapy (Morrison et al., 1995) and whether specific disorders are characterised by specific cognitive content and vulnerabilities remain unclear. It is important to differentiate which factors and type of pathology are associated with which symptoms, in order to develop early interventions and treatments.

Both social anxiety and paranoia involve perceived threat. In clinical and subclinical samples, Freeman, Pugh and Garety (2008) found that paranoid and anxious thoughts are both associated with the anticipation of threat. Paranoia was defined as interpreting ambiguous stimuli in the direction of intent to cause harm (e.g., "People are out to get me"). Paranoid symptoms are observed in the general population as well as being associated with persecutory ideations at clinical levels (Freeman, 2007a). Social anxiety is also implicated in misinterpreting ambiguous information, and is particularly relevant to negative evaluations (e.g., "People are laughing at my outfits"; Clark & Wells). Common factors reflect different experiences. Socially anxious and paranoid individuals interpret the same information in different ways. This might enhance the perception of threat, increasing negative emotions and hallucinations and perpetuating the disorder.

1.1.2 Clinical Interventions in Cognitive Bias

Clinical interventions in early psychosis suggest an aetiological role for cognitive bias in both its development and maintenance (Gumley et al., 2006). Appraisals and interpretations of prodromal symptoms play a role in the development of psychotic disorders and in how willing individuals are to seek treatment (Garety et al., 2001). Compared to individuals presenting with a first episode of psychosis, those with an At Risk Mental State (ARMS) for psychosis were better able to appraise anomalous experiences as symptoms of illness and more willing to seek and accept clinical help (Lappin et al., 2007). Early intervention in ARMS can arrest deterioration, in part by minimising neurobiological changes, improving the prognosis, delaying the onset of psychosis and preventing illness (Yung et al., 2008; Ruhrmann & Schultze-Lutter, 2003).

Many of the disabilities associated with psychotic disorders are difficult to treat (McGorry et al., 2009), emphasising the significance of early intervention, at the prodromal stage, before the first episode of psychosis (McGorry et al., 2003, 2001). Successful attempts at cognitive intervention have lent credibility to a cognitive focus in psychotic disorders. Cognitive-behavioural therapy (CBT) is the most common intervention, typically combined with antipsychotic medication. The focus of CBT is to change the thought processes of individuals in order to help them better manage their symptoms and distress, as well as to improve their cognitive and social functioning. The efficacy of CBT in psychosis has been demonstrated (e.g., Pilling et al., 2002; Zimmermann et al., 2005; Wykes et al., 2008). A growing number of studies also suggest it may be effective in the ARMS group. In a randomised controlled trial combining CBT and antipsychotic medication, the onset of psychosis was delayed in an ARMS sample, although the relative contribution of each type of treatment was unidentified (McGorry et al., 2002). In a comparison of CBT with antipsychotics, the former significantly reduced the likelihood of symptoms developing into psychosis (Morrison et al., 1995). These results were replicated in later studies that integrated treatments such as social skill training and psychoeducation (e.g., Nordentoft et al., 2006) and in a longitudinal study over a three-year period (French et al., 2007). Recent experimental work suggests that computer-based techniques for cognitive intervention are also useful. Cognitive bias modification (CBM) is conducted using a computer-based training

program to induce attention and interpretation bias. Studies have thus far focused exclusively on affective disorders (Yiend, 2004). The possibility of inducing interpretation bias in ambiguous statements has been observed in subclinical volunteers (Yiend et al., 2005) and clinical patients (Hayes et al., 2014). Individuals who score highly on the anxious trait produce increasingly positive interpretations of ambiguity when receiving induction training in positive interpretations (Mathews et al., 2007). Positive inductions improve mood (Holmes et al., 2006) and reduce vulnerability to external stressors (Hoppitt et al., 2010). The training procedure itself reduces general anxiety (Clerkin et al., 2015), social anxiety (Beard, Weisberg & Amir, 2011), depression (Joormann, Waugh & Gotlib, 2015) and psychosis (Steel et al., 2010). These findings are cause for optimism. Other research indicated the successful integration of CBM into existing Internet-based CBT programs (Williams et al., 2015). However, studies with larger samples and in populations other than individuals with affective disorder are required.

1.2 Interpretation Bias in Disorders

1.2.1 Interpretation Bias as a Cognitive Process

Interpretation refers to the process whereby ambiguous information is transformed into mental concepts, symbols or statements (Blanchette & Richards, 2010). Biased interpretation refers to the process whereby information is interpreted according to mood. It may lack a neutral outlook or consistently favour a particular stimulus in the information provided. It implies distortion and misinterpretation of the content, or something imagined that might be caused by temporary negligence, subjective presuppositions or an objective grasp of reality (Funder, 1987; Taylor & Brown, 1988). In biased interpretations, cognitive processing is based more on mood-congruent information than on evidence. It is characterised by incomplete data gathering and shortcuts, as opposed to unbiased interpretation, in which individuals make more accurate inferences and interpretations according to a logical, identifiable process (Taylor & Brown, 1988). Biased interpretation is not only typical of emotionally-disordered individuals; positive bias is also observed in emotionally stable populations (Mathews & MacLeod, 2002). There is ample literature on the presence of positive, self-serving biases in the general population (Taylor & Brown, 1988). In

particular, prior expectations and self-serving interpretations weigh heavily into the social judgment process. For example, Alloy and Abramson (1979) found that non-depressed college students systematically overestimated their actual control of desirable outcomes in the judgement of response-outcome contingency experiment. A review of over 266 studies by Mezulis, Abramson, Hyde and Hankin (2004) confirmed the pervasive self-serving attribution bias: people are more likely to attribute positive events to themselves than they are negative events (cf. Campbell & Sedikides, 1999).

Mood-congruent information processing bias is the most central concept to the cognitive theories of emotional disorders (Yiend & Mackintosh, 2004; Koster, Fox & MacLeod, 2009). Vulnerable individuals interpret ambiguous information in a mood-dependent way, based on their beliefs or expectations. This biased interpretation further contributes to the development and maintenance of psychopathology, strengthening beliefs and reinforcing relevant memories (Mogg & Bradley, 1998; Mathews & Mackintosh, 1998). Interpretation bias, attention bias, memory bias and other cognitive vulnerabilities are common in emotional disorders, although they present differently in different disorders. Interpretation bias refers to the process whereby information is interpreted according to mood (Blanchette & Richards, 2010). Attention bias refers to the preferential attention to information that is associated with mood (Mathews et al., 1997). Memory bias refers to the tendency to selectively recall memories that are congruent with a current emotional state (Bower, 1981). Specific forms of biased processing predict the risk of developing particular disorders (Mathews & MacLeod, 2002). For example, theories of psychosis assign primary importance to reasoning bias in the formation of delusional beliefs (Freeman, Garety, Kuipers, Fowler & Bebbington, 2002; Blackwood, Howard, Bentall & Murray, 2001), whereas theories of social anxiety emphasise negative interpretational bias (Mathews & Mackintosh, 1998; Rapee & Heimberg, 1997) and theories of depression emphasise the salient role of biased attribution style (Beck, 1976; Greenberg, Pyszczynski, Burling & Tibbs, 1992).

Interpretation bias in different emotional disorders has been comprehensively studied using various strategies: resolution of homophones (Eysenck, MacLeod & Mathews, 1987; Lawson et al., 2002), homograph (Richards & French, 1992; Hazlett-Stevens & Borkovec 2004), ambiguous sentence (Eysenck, Mogg, May, Richards & Mathews, 1991; MacLeod & Cohen,

1993), ambiguous scenarios (Hirsch & Mathews, 1997; Hitchcock & Mathews, 1992) and, more recently, the resolution of ambiguous stimuli online (Beard & Amir, 2010), morphed ambiguous facial expressions (Richards et al., 2002 Webb, Fox & Young, 2002), and the manipulation of interpretation (Yiend, Mackintosh & Mathews, 2004). These experiments involve stimuli with threatening or neutral meaning (e.g., the homophones weak/week), as well as tasks of spelling or evaluation probability, reaction time, lexical decision speed and naming latency. Results are generally consistent and yield strong evidence for emotion-related differences in interpreting threatening versus nonthreatening meanings of ambiguous stimuli. Emotionally disordered individuals are more likely than the general population to access the threatening meaning of ambiguous information. They might interpret ambiguity in a more negative or threatening way and/or reflect an absence of positive thinking.

1.2.2 Cognitive Bias to be considered as Interpretation Bias

In addition to interpretation bias, different types of cognitive bias have been considered in the literature, including memory recall bias, judgment bias, attribution bias, reasoning bias, jumping to conclusions and data gathering bias. Interpretation bias refers to the process whereby information is interpreted according to mood (Blanchette & Richards, 2010). Memory recall bias refers to the tendency to selectively recall memories that are congruent with a current emotional state (Bower, 1981). Judgment bias is defined as the tendency to make judgments by overestimating or underestimating the cost and probability of content-specific events (Butler & Mathews, 1983; Foa, Franklin, Perry & Herbert, 1996). Attribution bias is a cognitive process whereby individuals interpret stimuli by making causal attributions (Teghisi & Fagin, 1984). Reasoning bias, sometimes referred to as 'jumping to conclusions' (Peters & Garety, 2006; So, Freeman & Garety, 2008) and data gathering bias (Black, Howard, Bentall & Murray, 2001; Broome et al., 2007) pervades the literature. It refers to an information processing style whereby individuals reach a decision or make interpretations based on minimal information in situations in which comprehensive sources are available (Huq, Garety & Hemsley, 1988). These biases have been examined in the context of various emotional disorders. Results consistently show that individuals with emotional disorders prefer a specific interpretation style.

1.2.2.1 Judgment Bias

Judgment bias is defined as the tendency to make judgments by overestimating or underestimating the cost and probability of content-specific events (Butler & Mathews, 1983; Foa, Franklin, Perry & Herbert, 1996). Biased estimates of risk might be made based on judgemental heuristics such as the availability of one's own memory and the representativeness of the event (Tversky & Kahneman, 1980). Factors such as self-evaluation of performance (Cane & Gotlib, 1985), overall life satisfaction (Schwarz & Clore, 1983) and subjective anticipation of future events (Butler & Mathews, 1983) may also contribute to biased judgements. Although vulnerable individuals consistently display a less positive judgment style, judgment bias is not uniquely associated with emotional disorders (Williams et al., 1988; Mathews, 1988). Non-depressed students exhibited biased judgment, overestimating their control of their responses over outcomes (Alloy & Abramson, 1979). Nevertheless, affective factors such as depression, anxiety and phobias are also associated with judgment bias. In the same series of early studies (Benassi & Mahler, 1985), depressed students were less optimistic but more accurate judges than were non-depressed students when asked to judge the degree of personal control they had over certain outcomes. Both depressed and non-depressed students overestimate the control others have over outcomes (Martin, Abramson & Alloy, 1984). Aided by self-referential judgments, depressed patients recalled more emotionally negative than positive events in a homograph recall task (Hertel & Brozovich, 2010). Anxious individuals interpret ambiguous stimuli as threatening. Patients with social anxiety disorders overestimate the probability and cost of negative social outcomes (Amin et al., 1998; Stopa & Clark, 1993, 2000). Individuals with social anxiety exhibited higher future probabilities for negative social events and lower probabilities for positive events (Gilboa-Schechtman, Franklin & Foa, 2000). Individuals vulnerable to panic dramatically overestimate the proportion of fear-relevant stimuli and aversive outcomes (Sutton, Mineka & Tomarken, 1991). These results suggest that judgment bias is pervasive in emotionally vulnerable individuals, and that such bias consolidates pathological beliefs.

1.2.2.2 Attribution Bias

Attribution bias is a cognitive process whereby individuals interpret stimuli by making causal attributions (Teglass & Fagin, 1984). Studies suggest that estimated control over an event

(Weiner, 1985), comparison with others (Kelley, 1967), self-esteem, and the internality, stability and global nature of the cause (Abramson, Seligman & Teasdale, 1978) all contribute to developing the bias. Cognitive theories of emotional disorder suggest that this biased attribution might determine how an individual evaluates their own competence, in order to cope with future unexpected incidents (Stopa & Clark, 1993). According to cognitive theories of depression, the tendency to make negative, self-related and future-related interpretations after aversive life events is a crucial feature of these disorders (Abramson, Metalsky & Alloy, 1989). Attribution bias has been investigated extensively in depression, to a lesser extent in anxiety and more recently in psychosis. The Attributional Style Questionnaire (ASQ; Peterson et al., 1982) is one of the most frequently used to test attribution bias (Garety & Freeman, 1999). It is primarily employed to investigate attribution bias in depression. The questionnaire includes various categories of events. Respondents are required to write down a major cause of the event as well as to rate it in dimensions of internality, stability and globalness. Extending the ASQ in the internality dimension, Kinderman and Bentall (1996b) developed a new scale, the Internal Personal and Situational Attributions Questionnaire (IPSAQ), which includes three distinct attribution categories: internal, external-personal and external-situational. In addition to the Social Attributions Questionnaire (SAQ; Bentall et al., 1991), the IPSAQ is also frequently used to investigate attribution bias. As opposed to a self-referential task, it involves judging social interactions between two hypothetical persons. In the depression literature, an internal attribution style for negative life events has been identified as a causal factor in depression and low self-esteem, particularly if it is interpreted as stable, thus diminishing hope for the future (Riskind & Alloy, 2006; Alloy et al., 1999, 2006). Social anxiety points to negative internal characteristics, and is associated with the belief that threatening social events may result in the negative evaluations of others (Wilson & Rapee, 2004; Gilboa-Schechtman, Franklin & Foa, 2000). Attribution style in psychosis is central to delusional ideation (Allen, Freeman, Johns & McGuire, 2006; Johns, Gregg, Allen & McGuire, 2006; Bentall, 1994). These results suggest that people with psychosis have a biased attribution style, attributing self-referential threatening events to external causes, particularly to people as opposed to the environment and to chance (Garety & Freeman, 1999).

1.2.2.3 Reasoning Bias, Jumping to Conclusion and Data Gathering Bias

Reasoning bias, sometimes referred to as 'jumping to conclusions' (Peters & Garety, 2006; So, Freeman & Garety, 2008) and data gathering bias (Black, Howard, Bentall & Murray, 2001; Broome et al., 2007) pervades the literature. It refers to an information processing style whereby individuals reach a decision or make interpretations based on minimal information in situations in which comprehensive sources are available (Huq, Garety & Hemsley, 1988). Increased state of anxiety may contribute to reasoning bias, and interact to influence the development of psychosis (Lincoln et al., 2010; Exner & Moritz, 2009). The beads task (Huq et al., 1988, 1988), based on the classical paradigm by Philips and Edwards (1966) is most commonly used to test reasoning bias. Participants were asked to decide from which jar randomly drawn beads had come, after being shown mixed coloured beads. Fewer beads required before reaching a decision implies a greater tendency to jump to conclusions. Numerous studies have replicated and modified this task for use in subtypes of psychosis. Results consistently suggest that reasoning bias contributes to acquiring and reinforcing delusional beliefs (Garety & Freeman, 1999; Fine, Gardner, Craigie & Gold, 2007; Freeman et al., 2002; Garety et al., 2007). Individuals with symptoms of delusion form conclusions by gathering less evidence than do normal controls and demonstrate difficulties with using sequential information and weaknesses in formal logic. Reasoning bias is also observed in other disorders. For example, patients with autism spectrum disorder (ASD) demonstrated a rational and logical decision-making style, and experienced greater difficulty making decisions (Brosnan, Chapman & Ashwin, 2014). Individuals with social anxiety exhibit a deductive reasoning style, reaching decisions by endorsing prior plausible beliefs rather than by considering standard logic (Vroling & Jong, 2009).

1.2.2.4 Lack of Alternative Interpretation

Biased interpretation has been understood as a lack of alternative interpretations, or as a lack of neutral alternatives (Franklin, Huppert, Langner, Leiberg & Foa, 2005; Freeman et al., 2004) and investigating alternative interpretation is fundamental to psychological and psychiatric intervention (Freeman et al., 2004; Kuipers, Bebbington & Dunn, 2004). A lack of knowledge, the inability to gather alternatives and the unacceptability of consequences make it difficult to generate alternative interpretations. The relevance of stimuli to the previous

experience of the individual might limit the extent to which they consider alternative interpretations (Eysenck et al., 1987, 1987). Recent work on psychosis reveals that a lack of willingness to consider alternative interpretations is associated with the severity of the delusion (Garety et al., 1997; Garety, Kuipers, Fowler, Freeman & Bebbington, 2001). Isolation from social situations and reduced access to alternative, normal interpretations might contribute to psychotic appraisals (White et al., 2000). In a study of 100 patients, three-quarters did not have available alternative interpretations for their experiences; delusions were their only explanation (Freeman et al., 2004). Patients also demonstrated a more hasty reasoning style than participants with accessible alternative interpretations. Patients with emotional disorders are taught to generate alternative interpretations for ambiguous social scenarios using cognitive bias modification, successfully reducing information processing bias (Hirsch, Hayes & Mathews, 2009; McManus, Clark & Hackmann, 2000).

1.2.3 Cognitive Theories of Interpretation Bias

1.2.3.1 Beck's Schema Model

Based on systematic clinical observations of depressed and non-depressed patients during psychotherapy, Beck employed the term 'schema' to designate a cognitive-affective model of depression. According to the model, the thoughts and affects typical of depression are characterised by specific cognitive patterns. The schema includes all aspects of processing, such as attention, reasoning and memory (Beck, 1964; Beck et al., 1979). Characteristic thoughts affect how the salient features of information are labelled and recognised, influencing beliefs and attitudes and determining responses to events (Beck, 1964). The content of schemas reflects the typical cognitive process biases (Beck, 1964). Anxiety and depression are characterised by cognitive biases, which differ in content. Anxious individuals process anxiety-related stimuli (anticipation of threat); depressed individuals, depression-related stimuli (self-depreciation). Studies on the Beck (1964) model yield mixed results. Depression appears associated primarily with later-stage cognitive bias, such as memory; anxiety with early-stage cognitive bias, such as attention (Mogg & Bradley, 1998; Mathews, 1990; Williams et al., 1988). These results suggest that psychotherapy might most effectively

be conducted by focusing on modifying the underlying biased cognition, helping the patient to consider alternative, more realistic hypotheses when making interpretations.

1.2.3.2 Bower's Network Theory

Later work focused on the development and maintenance of state dependent cognition. Bower et al. (1981) introduced an associative network theory, in which anxiety, depression and happiness are conceptualised as distinct cognition units with characteristic cognitive patterns. The affect activates retrieval of primarily positive or negative memories associated with a stimulus, biasing subsequent cognitive processes by priming mood (Bower, 1981). Rather than trait emotion, Bower was particularly interested in how state emotion (current mood) and cognition work on each other. Implied by the network model (Bower, 1981), the current emotional state affects the associated cognitive processes: the interpretation of ambiguity and the salience of congruent emotional material. Current mood influences the way in which individuals elaborate on inferences from ambiguous events and whether their interpretations and predictions are positive or negative (Bower, 1981). State mood therefore biases the interpretation of ambiguous material, since such a mood is primed. For example, a happy person seems ready to provide an optimistic interpretation, whereas a grouch prefers to find fault. However, Bower argued that whether the priming of the mood is 'automatic' or happens by 'demand' is still not clear, and could be an important item on the research agenda.

Beck's schema model and Bower's network model generate a common hypothesis: that depression and anxiety are characterised by mood-congruent bias in all aspects of cognitive processing, including attention, reasoning and memory. The content of each determines the cognitive processes with which they are associated: anxiety with threat and depression with failure (Mogg & Bradley, 1998). Anxiety involves attention to and interpretation bias for threat-related information (MacLeod et al., 1986; Eysenck, 1992); depression involves memory bias for negative information (Mathews & Bradley, 1983). Some authors argue that cognitive bias in anxiety prevails during the early stages of cognitive processing; depression at a later, controlled stage (Mogg et al., 1993).

1.2.3.3 Affective Decision Mechanism, Resource Allocation Mechanism and Cognitive Motivational Analysis

Williams et al. (1988) introduced a revised cognitive theory of anxiety and depression, based on two mechanisms: the Affective Decision Mechanism (ADM) and the Resource Allocation Mechanism (RAM). Consistent with previous theories, each emotional disorder was associated with a specific biased cognitive pattern. The ADM works to evaluate whether a stimulus is positive or negative by recognising both the nature of the stimulus and the pre-attentive, automatic biased mood of the individual. The ADM output feeds into the RAM, allowing the trait emotion to allocate pre-attentive bias to threat stimuli. For instance, highly anxious individuals might tend to endorse threat elements of a stimulus, whereas non-anxious individuals might shift their attention from the threat. Such distinct mechanisms have significant implications for psychotherapy. RAM bias determines individual differences in vulnerability to symptoms, so treatment could specifically target this mechanism by correcting the bias (Mogg et al., 1998). The hypothesis that pre-attentive and attention bias determine subsequent cognitive vulnerability to clinical symptoms is also a key feature of Eysenck's (1991) theory of anxiety. He also suggested that trait anxiety is associated with information scanning. The high trait anxiety individual displays a broadening attention before recognising a stimulus, and might narrow the attention once the stimulus has been labelled.

Mogg et al. (1993) conducted a series of studies to test the hypothesis that pre-attentive bias dominates in anxiety. The results support Williams et al. (1988), in that pre-attentive bias is observed in anxiety, and anxiety differs cognitively from depression. Focusing mainly on pre-attentive and attention processes, Mogg and Bradley (1998) provided a systematically theoretical account of anxiety, suggesting that biased cognitive processes play an important role both in determining cognitive behavioural responses and in generating and maintaining state emotion. Better theories and models might lead to more effective interventions for emotional disorders (Mogg & Bradley, 1998).

These theories all emphasise the crucial role of biased cognition in developing and maintaining emotional disorders. There is ample work on attention and memory in this field, but little on interpretation bias.

1.2.3.4 Selective Processing in Anxiety

Mathews and Mackintosh (1998) described a cognitive model of selective processing in anxiety that not only suggests a critical role for competition and prediction of degrees of threat in attention bias, but also accounts for interpretation bias. According to the model, anxiety states are associated not only with biased attention to threat, but also with a tendency for interpreting ambiguity negatively. They proposed a Threat Evaluation System (TES) similar to the ADM (Williams et al., 1988). Both positive and negative stimuli arising from ambiguous information are matched using the TES. After competitive emotional evaluation in the system, during which output is enhanced by current mood, a positive or negative interpretation prevails (Mathews & Mackintosh, 1998). A more threatening interpretation may be enhanced by a prevailing anxious mood in anxious individuals, and a more positive interpretation consolidated by positive current emotions in others.

1.2.4 Interpretation Bias in Emotional Disorders

According to cognitive theories, biases in interpreting mood-congruent information play a role in emotional disorders (Beck, Emery & Greenberg, 1985; Clark & Beck, 1988; Clark & Wells, 1995; Mathews & MacLeod, 1994; Mathews & Mackintosh, 1998). The most commonly observed interpretation bias is that highly emotionally vulnerable individuals interpret emotionally ambiguous material in threatening or less neutral ways. Ambiguity has been presented in homophones (Butler & Mathews, 1983), homographs (Hazlett-Stevens & Borkovec, 2004), sentences, scenarios, facial expressions (Richards et al., 2002; Webb, Fox & Young, 2002) and video actions, with interpretations operationalised as participant recognition, self-report, similarity ratings, lexical decisions and reaction time. Recent research supports these findings in anxiety disorders, especially social anxiety disorders (Constans, Penn, Ihen & Hope, 1999; Stopa & Clark, 2000; Calvo & Castillo, 2001; Voncken, Bögels & de Vries, 2003; Huppert, Foa, Furr, Filip & Mathews, 2003). When asked to rate video social interactions, highly socially anxious students rated ambiguous videos more negatively than did non-anxious, dysphoric students (Amir, Beard & Bower, 2005). The findings of a reaction time paradigm were similar (Amir, Beard & Przeworski, 2005). Rather than responses to a single interpretation, responses to an open-ended task were examined in another study of patients with social phobia, and the findings were consistent (Franklin,

Huppert, Langner, Leiberg & Foa, 2005). Using similar task strategies, Vassilopoulos (2006) found that a subclinical population yielded the same results. This bias could indicate negative personal characteristics and be associated with depression (Wilson & Rapee, 2005). Examining the multiple interpretations of participants for each ambiguous social scenario, revealed that highly socially anxious individuals presented more negative and less positive responses than did controls (Huppert, Pasupuleti, Foa and Mathews, 2007). Using a facial expression task, Gilboa-Schechtman, Foa, Vaknin, Marom and Hermesh (2008) demonstrated negative bias in both socially anxious and depressed individuals; both also found it difficult to generate positive interpretations. According to another study, highly socially anxious individuals overestimate the social cost of social interaction (Schofield, Coles & Gibb, 2007). This biased interpretation is arguably content-specific for socially-relevant events, and might distinguish socially anxious from depressed patients (Voncken, Bögels & Peeters, 2003). All these studies used classical offline, self-report measures. Interpretation bias in social anxiety has also been studied using event-related brain potentials (ERPs), revealing a negative and lack of positive bias in the socially anxious group (Moser et al., 2008). Beard and Amir (2010) confirmed this finding in a mixed methodology study of self-report and reaction time paradigms. This lack of positive bias was replicated in clinical samples. However, patients with social phobia do not demonstrate a negative interpretation bias with reaction time measure (Amir, Prouvost & Kuckertz, 2012). Another study provided support for the cognitive model of social phobia: that interpretation bias mediates the relationship between state and trait anxiety (Beard & Amir, 2009). Apart from the trait and state mood, biased attention and anxiety-related negative interpretation were linked and similar mixed methodology revealed a lack of positive bias in social phobic and depressed patients (White, Suway, Pine, Bar-Haim & Fox, 2011). Interpretation bias is thus evident in anxiety and depression in both clinical and subclinical populations, and manifests as both a negative and a lack of positive interpretation. However, a lack of positive bias does not confirm a negative interpretation; these are independent (Amir et al., 2012, 2012).

Interpretation bias has also been observed in other emotional disorders, notably depression and panic disorders. In depression, interpretation bias refers to a tendency to interpret ambiguous everyday events negatively and is proposed as the central mechanism of

continued depressed mood (Lawson, MacLeod & Hammond, 2002; Rude, Valdez, Odom & Ebrahimi, 2003; Hoppitt, Mathews, Yiend & Mackintosh, 2010; Blackwell & Holmes, 2010; Borna, Lang, Goodwin & Holmes, 2011). In panic disorders, vulnerable individuals only make biased interpretations when the scenario matches specific concerns related to their panic; such panic-related interpretation bias might contribute to the development and onset of panic disorder (Richards, Austin & Alvarenga, 2001; Teachman, Smith-Janik & Saporito, 2007; Rosmarin, Bourque, Antony & McCabe, 2009). In eating disorders, the interpretation bias tends towards appearance concern, maintaining and exacerbating the concern (Ainsworth, Waller & Kennedy, 2002; Fairburn, Cooper & Shafran, 2003; Rosser, Moss & Rumsey, 2010). Biased interpretation has also been observed in post-traumatic stress disorder (PTSD), in which patients are more likely to interpret current experiences in relation to their trauma (Buckley, Blanchard & Neill, 2000; Ehlers & Clark, 2000; Amir, Coles & Foa, 2002; Karl, Malta & Maercker, 2006), and in obsessive-compulsive disorder (OCD; Rachman, 1997).

1.2.5 Interpretation Bias in Psychotic Disorders

Cognitive theories of psychosis suggest that biased cognitive processing in emotional disorders might also contribute to the development and maintenance of the positive symptoms of psychosis (Bentall et al., 2001; Chadwick & Birchwood, 1994; Freeman et al., 2002; Garety et al., 2001; Morrison, 1998). Specific biases towards negative, threatening, and/or persecutory interpretations play an important role in the distress associated with these symptoms. Previous work has focused on the interpretation of voices (Morrison, Nothard, et al., 2004; Bowe & Wells, 2004), facial expressions (Wout et al., 2007) and virtual reality (Freeman et al., 2008), measured using semi-structured interviews and self-reports. Earlier research on auditory hallucinations (see Morrison, 2001 for a review) consistently show that misinterpreting auditory hallucination as threatening can cause distress, which is maintained by safety behaviours (Morrison et al., 1995; Chadwick & Birchwood, 1994). In a series of studies on auditory hallucination, batteries of self-report questionnaires and a structured clinical interview revealed that psychotic patients with auditory hallucinations make more threatening interpretations than do psychiatric patients and controls, and that they perceived this biased interpretation as more distressing and less controllable (Morrison

& Baker, 2000). Psychotic patients are more worried and form more negative interpretations about danger and uncontrollability than do patients with persecutory delusions and normal controls (Morrison & Wells, 2003). Patients with hallucinations interpret the voices more negatively and have a greater tendency to experience hallucinations (Morrison, Nothard, Bowe & Wells, 2004). A unique association between distress and interpreting voices in a dominating, insulting manner was found (Vaughan & Fowler, 2004). Similar to the research strategy used in studies on emotional disorders, the computerised facial expression task was used to investigate interpretation and attribution styles in schizophrenia. Results suggest that patients are much less accurate recognising facial expression, misinterpreting negative facial emotion as neutral (Premkumar et al., 2008). By combining facial expression with audio as well as reality environment, Freeman et al. (2008) demonstrated the links between paranoia and cognitive vulnerability with affective disturbances in the general population, and suggested that threatening interpretation might be due to anomalous experiences accompanied by affective disturbances. Biased interpretation has also been observed in bipolar disorders. Recent research suggests that patients with bipolar disorder have a different interpretation intention than do non-patient groups, favouring ambiguous and angry interpretations and hostile, aggressive, guilty intentions (Lahera et al., 2012).

1.3 Interpretation Bias in Paranoia

1.3.1 Paranoia

1.3.1.1 Paranoia in Everyday Life

The term paranoia is derived from the Greek, "madness" (Lewis, 1970), and describes an inclination to be touchy, hostile and aggressive (Pavlovský, 2005). It was reintroduced as a prominent condition in persecution delusions in the 19th century (Randall et al., 2003). Persecutory beliefs were defined as a perception that one is psychologically or physically threatened by others (Freeman & Garety, 2000). Patients might believe such persecution is undeserved ("poor me") or deserved ("bad me"); that one is an innocent victim or punished for one's misdemeanours (Trower & Chadwick, 1995). These symptoms occur in milder form in everyday psychology, and are prevalent in non-clinical people. Fenigstein and Venable (1992) developed a valid and reliable Paranoia Scale for use in the general population, on

which more than half (62%) of participants endorsed a paranoid scale item as at least slightly self-descriptive, and the mean total was 42.7 (range: 20-100, SD=10.2) with no significant gender differences. Subclinical paranoia was defined as biased self-referential thoughts, with features such as mistrust, self-focused thought, suspiciousness, feelings of ill-will or hostility and conspiratorial intent (Fenigstein & Vanable, 1992; Fenigstein, 1997). Results from a three-year epidemiological study of 7075 Dutch citizens indicated that 4.2% of the general population showed evidence of delusions or hallucinations, and 17.5% of the population reported psychosis-like experiences (van Os, Hanssen, Bijl & Ravelli, 2000). In a 15-year cohort study of 761 New Zealand residents, 12.6% were diagnosed paranoid by the age of 26 years (Poulton et al., 2000). In a sample of 324 college students, 47% to 70% reported paranoia: a perception that others intended to harm them (Ellett, Lopes & Chadwick, 2003). In an online questionnaire administered to 1202 individuals, 15 to 20% of the sample reported thoughts of paranoid content, 5% suspected a conspiracy against them and 20% were distressed at these thoughts (Freeman et al., 2005). In a recent virtual reality study, over 40% of the general population sample reported paranoid thoughts (Freeman et al., 2008). Taken together, these findings reveal high levels of paranoia and paranoid thoughts in the general population (Combs, Penn & Fenigstein, 2002; Combs, Michael & Penn, 2006). Paranoid beliefs are associated with social circumstances, such as powerlessness and victimisation (Harper, 1994; Janssen et al., 2003); demographic risk factors, including lower educational levels, younger age and isolation (Marcelis et al., 1998; van Os, Hanssen, Bijl & Ravelli, 2000); public self-consciousness and self-attention (Fenigstein & Vanable, 1992); perceptual abnormalities (Phillips et al., 1999; Peer et al., 2004); lower self-esteem and negative self-evaluation (Bentall et al., 2001; Freeman, 2006); and higher distress, worry and anxiety (Freeman et al., 2008; van Os et al., 2000). The interaction of these social and cognitive factors with paranoid experiences predicts the onset of psychotic illness and other severe disorders in the general population (Chapman et al., 1994; Kwapil et al., 1997).

1.3.1.2 Paranoid Psychosis

Paranoia ranges from daily paranoid beliefs in the general population to clinical symptoms, including paranoid delusions in paranoid psychosis (Combs & Penn, 2003; Fenigstein &

Vanable, 1992). The most common psychotic symptom is delusions (Breier & Berg, 1999; Loch et al., 2011). In nearly half the cases, persecutory delusions involve suspiciousness or persecution (Freeman, 2007b). Paranoid schizophrenia is categorised as a subtype of schizophrenia in the fifth edition Diagnostic and Statistical Manual of Mental Disorders (DSM-V). Its dominant symptoms are delusions or auditory hallucinations. Typical delusions present with persecutory and suspicious ideation and are associated with affective and cognitive disturbance. In persecutory ideation, “the individual believes that harm is occurring, or is going to occur, to him or her, and that the persecutor has the intention to cause harm” (Freeman & Garety, 2000, p.427). Paranoid psychosis is less prevalent in the general population. Based on DSM-IV criteria, there is a lifetime prevalence of approximately 1.5% for psychosis (Kessler et al., 2005; Gureje, Olowosegun, Adebayo & Stein, 2010). The prevalence of persecutory delusions is approximately 0.4% (Gureje, Olowosegun, Adebayo & Stein, 2010), with males demonstrating significantly higher lifetime rates than females (Morgan et al., 2013). Some argue that paranoid psychosis might exist on a continuum (van Os et al., 2000; Johns, 2005; Loch et al., 2011). Approximately 10% of the non-clinical population reported symptoms of clinical psychosis, such as paranoid ideation (Freeman, 2007a). In a general population sample of 7076 individuals, 2.1% met the criteria for psychosis, and 17.5% reported at least one positive psychotic symptom (Van Os et al., 2000). When 1464 Sao Paulo residents were interviewed using the Composite International Diagnostic Interview (CIDI), 1.9% of the total sample met the criteria for diagnosis of ICD, while 38% reported at least one symptom of psychosis (Loch et al., 2011). Copious research reveals an association between affective symptoms and increased risk of developing symptoms of paranoid psychosis. There is strong evidence for the link between anxiety and paranoid beliefs (Freeman et al., 2005a; Fowler et al., 2006) and anxiety and persecutory delusions (Freeman, Garety, Kuipers, Fowler & Bebbington, 2002; Huppert & Smith, 2005). Anxiety arguably contributes to all stages of the development and maintenance of paranoia (Freeman & Garety, 2003). Anxiety disorders and psychosis are highly comorbid (Michail & Birchwood, 2009, 2013) and low self-esteem and depression are also associated with psychosis (Freeman et al., 2001; Bentall & Kaney, 2005; Hartley, Barrowclough & Haddock, 2013; Lyon et al., 2014). Both paranoia and low self-esteem are

the result of negative internal and external beliefs, which are correlated with the distress of paranoid experiences (Freeman, 2007a). Finally, cognitive vulnerability is also significantly correlated with psychosis. Biased attentions (Williams, Watts, MacLeod & Mathews, 1988; Yiend, 2010), biased reasoning styles (Van Dael et al., 2006; Ellett, Freeman & Garety, 2008; Startup, Freeman & Garety, 2008; So et al., 2012), biased interpretations (Morrison, Northard, Bowe & Wells, 2004), biased attribution styles (Jolley et al., 2006; Ambrojo & Garety, 2009).

1.3.2 Cognitive Theories of Paranoia

Considering the nature of paranoia, which ranges from suspicious beliefs to persecutory delusions, cognitive theories of persecutory delusions were reviewed here in order to gain a comprehensive picture of the development and maintenance of paranoia.

1.3.2.1 Mechanisms of the Risk of Paranoia

Bentall et al. (1994) suggested three types of mechanism that might contribute to the risk of paranoia: perceptions of abnormal experiences (e.g., the individual believes his partner has been replaced by a impostor), impaired reasoning processes (e.g., jumping to conclusions) and biased attribution styles. These authors argue that attribution bias is the core element of the paranoia model. Paranoid individuals tend exaggeratedly to attribute negative events to external causes. By blaming others for negative outcomes, negative perceptions about the self are prevented from reaching consciousness. This attribution triggered defensive explanatory bias, and defence against low self-esteem by minimising discrepancies between self-representation (actual self) and how one perceives others view the self. These interactions are cyclical, affecting one's self-representations and beliefs about the mental states of others and about the outside world, influencing their future attributions and contributing to the development of cognitive vulnerability to paranoid thinking.

1.3.2.2 Garety & colleagues and Freeman & colleagues

Freeman et al. (2002) incorporated the attribution mechanism proposed by Bentall et al. (1994). Rather than focus on defensive attribution, however, a stress-vulnerability framework was proposed that assumed that emotional processes, especially anxiety, contribute

significantly to the development and maintenance of persecutory delusions. According to this model (referred to figure 5.2 for the formation of a persecutory delusion), the formation of persecutory delusion begins with an internal or external event (e.g., life-event, drug effect), occurring in the context of emotional distress. Vulnerable individuals might experience a series of internal anomalies, ranging from abnormal voices and unconscious behaviour to subtle cognitive dysfunction and emotional disturbance. Vulnerable people search for explanations for external events and anomalous experiences. Individuals with persecutory ideas believe that they are vulnerable and others are threatening. Anxiety underlies this process and is directly associated with the content of persecution beliefs (Freeman et al., 2002). Anticipated anxiety typically reflects the persecutory beliefs of an individual, triggering anomalous experiences and exacerbating anxiety. Furthermore, higher levels of anxiety lead to greater use of safety behaviours, protecting persecutory beliefs by discarding alternative explanations. Incorporating other theories, Freeman et al. (2002) also emphasised the influence of cognitive bias in the formation and maintenance of persecution beliefs. An attention bias for threatening information was noted: the jumping to conclusion bias, in which limited information is considered in forming explanations; confirmation bias, in which only belief-consistent information is considered; interpretation bias, which involves threatening reference and persecution; reasoning bias, the tendency to jump to conclusions; and memory bias, where evidence of threat beliefs is provided. These biased cognitions manifest differently among individuals, as social factors (e.g., interactions with others). The personality of the individual is also influential.

1.3.2.3 Other Recent Cognitive Theories

The cognitive approach taken by Morrison focused on interpreting abnormal experiences in psychosis. In the model, positive psychotic symptoms, such as delusions and hallucinations, are considered intrusions into awareness. Interpreting such intrusions was suggested as the key cognitive factor in maintaining abnormal experiences. The interpretation of intrusive thoughts was influenced by one's experience, beliefs and knowledge. Misinterpretations were associated with faulty self and social understanding conceptualised as a psychotic phenomenon. For example, a psychotic individual may misinterpret a television license

inspector as evidence of a government conspiracy. These misinterpretations may increase emotional distress (e.g., anxiety), physiological dysfunction (e.g., sleep difficulty) and cognitive behavioural responses (e.g., safety behaviours), which lead to further abnormal experiences.

Reichenberg (2005) focused on more generic deficits in cognitive functions, suggesting that cognitive deficits represent a core impairment in psychosis. Consistent with Frith (1992), Reichenberg (2005) emphasised the role of abnormal cognitive functioning in persecutory delusions. Abnormal cognition impairs the ability to represent the mental states of others and to comprehend social complexities. This may lead to misinterpretation, paranoia and isolation.

In summary, different cognitive models of persecutory delusions are consistent with the role of cognitive dysfunction in persecutory beliefs. Attention bias, attribution bias, reasoning bias, interpretation bias, information-processing impairment and memory bias are the major components of each theoretical mechanism. In particular, negative interpretation is critical to the emotional distress associated with persecutory symptoms. However, theories are not yet reconciled as to the content of biased information. According to Bentall et al. (1996), persecutory delusions reflect an attributional defence; Freeman et al. (1999) argue such delusions reflect emotions. The terms used to describe similar stages of biased information processing are inconsistent, and distinctions between reasoning bias, attribution bias and interpretation bias must be clarified.

In the next section, the empirical evidence for biased information processing in paranoia will be summarised and discussed, with a focus on interpretation bias. In addition to studies on paranoia, relevant research on persecutory delusions and paranoid psychosis will be examined.

1.3.3 Recent Evidence on Interpretation Bias in Paranoia

Interpretation biases matching the concerns of a psychopathology have been implicated in the aetiology of emotional disorders, but little research has investigated their presence in psychosis. The most relevant works of interpretation bias in paranoia are from our own laboratory. In a nonclinical setting, Savulich, Freeman, Shergill and Yiend (2015)

investigated pathology-congruent interpretation bias in individuals with high levels of trait paranoia. They used one set of material permitting broadly positive/negative (valenced) interpretations, while another enabled more or less paranoid interpretations, thus allowing an investigation into the content specificity of interpretation biases associated with paranoia. They found that individuals with high trait paranoia interpreted ambiguous information more negatively than those with low trait paranoia and, crucially, that this effect was more pronounced for information directly related to paranoid concerns. This finding reveals that interpretation of paranoia-related information might underlie paranoid symptoms in individuals with higher vulnerability. Subsequently, a more comprehensive and methodologically rigorous investigation was conducted into interpretation bias in a clinical sample of patients with psychosis (Savulich, Shergill and Yiend, 2017). This study investigated paranoia-relevant interpretation biases in patients with schizophrenia, with and without paranoid symptoms, and matched healthy controls. Similar materials to those in the above subclinical study were used, including: the Similarity Rating Task, which measures interpretation bias with emotionally ambiguous passages; and the Scrambled Sentences Task, which measures interpretation bias by requiring participants to reorder strings of words to construct grammatically correct statements. This study also included a measure of data-gathering bias (the Jumping to Conclusion task) to illustrate the important conceptual differences between data-gathering biases (which have been widely investigated in psychosis populations) and the interpretation biases in emotion processing. Results showed negatively biased interpretations of emotionally ambiguous information in both patient groups compared to the healthy controls. Paranoid patients showing a stronger bias on material permitting paranoid interpretations than on other types of ambiguous information, however, mixed with evidence that this content-specific effect applied only to the paranoid patient group. This suggested biased interpretation specifically related to paranoia, and deserves further detailed empirical investigation as a putative causal and maintaining factor for psychosis symptoms.

Effects of cognitive bias on emotion processing have also been investigated in psychosis. These studies suggest interactions among interpretation bias, emotional distress and anomalous experiences (Freeman et al., 2002). The interpretation of abnormal experiences

and associated emotions was the primary focus. Both structured clinical interview and cognition questionnaires are typically used to measure interpretations of abnormal experiences, and baseline scales are usually included, to assess general levels of emotional distress. Psychotic patients reported auditory hallucinations and interpreted them as more uncontrollable and unacceptable more frequently than did the control group (Morrison & Baker, 2000). Interpretations of auditory hallucinations were associated with reported distress, and in fact predicted levels of distress. Similar results were replicated in other experiments. For example, Gaag, Hageman and Birchwood (2003) found that malevolent interpretation of voices is associated with anxiety and depression. Vaughan and Fowler (2004) then suggested that the contents of these malevolent voices independently linked with distressing emotional reactions. Other studies also found that beliefs about voices and contents of these voices were predictors of emotional characteristics of voices. Furthermore, the metaphysical beliefs were also predictors of voice-hearer's emotional status (Morrison et al., 2004; Close & Garety, 1998). In summary, interpretations of auditory hallucinations are directly associated with emotional distress, and the content of the interpretations may predict affect and behaviour.

The beads task is a classic tool used to assess reasoning bias. Huq, Garety and Hemsley (1986) first wrote on reasoning bias, which they termed "jumping to conclusion bias". Participants were presented with a series of different coloured beads and asked to guess from which of two jars beads were drawn. The results indicate that, compared to healthy participants and other clinical controls, participants with delusions collected less information before arriving at a conclusion. This interpretation style of jumping to conclusions is similar to data gathering reasoning bias. Results have been replicated using a modified task in similar group settings (Fine et al., 2007; Lincoln, et al., 2010; Peters & Garety, 2006; So & Kwok, 2015), in individuals at risk of mental disorder (Broome et al., 2007; Colbert & Peters, 2002) and in first episode psychosis (Falcone et al., 2010). Consistent results have also been found with an emotionally salient version of the task, in which positive or negative comments are presented to participants (Menon et al., 2008 & Kapur, 2008) and when using pictures of black and white fish, assumed to be caught from different lakes (Wood et al., 2009).

In addition to the above findings, the significance of emotion in reasoning bias and anomalous experiences such as delusions has also been demonstrated. Exposure to a stressful urban environment may increase paranoia, anxiety and the jumping to conclusion bias, and individuals with psychosis make more negative interpretations about others and the environments (Ellett, Freeman & Garety, 2008). Low IQ and emotional bias may also contribute to reasoning bias in more complex situations (Jolley et al., 2006) and state anxiety may increase jumping to conclusion bias and paranoid beliefs in healthy individuals (Lincoln, Ziegler, et al., 2010). Reasoning bias was significantly associated with higher levels of delusional conviction; however, the relationship was independent of emotional distress (Garety et al., 2005). Freeman and Garety (2008) suggest a direct link between jumping to conclusion bias and delusional beliefs. Further research on aetiology, perhaps focusing on content in order to test interpretation and reasoning styles, was suggested.

1.4 Interpretation Bias in Social Anxiety

1.4.1 Social Anxiety

1.4.1.1 Social Anxiety in Everyday Life

Social anxiety is pervasive in contemporary society. It is typically understood in lay terminology as shyness, and involves the fear and anxiety of being judged and evaluated in social situations that involve interaction with other people or performing in public (Heiser et al., 2009). It is associated with notions of psychological discomfort, such as being nervous, isolated, aloof, withdrawn and inhibited. The Fear of Negative Evaluation and Social Avoidance and Distress Scale (FNE & SADS, Watson & Friend, 1969) are widely used to measure these concepts in the general population. They measure expectation and anxiety related to the negative evaluation of others, as well as avoidance and distress stemming from social interactions. The social interaction anxiety scale (Mattick & Clarke, 1998) is another commonly used measure to assess cognitive, affective and behavioural reactions to general social interactions. 20 to 48% of the adult American population describes themselves as shy (Carducci et al., 2007). The prevalence of social phobia among shy people is 18%, significantly higher than the 2–8% in the general population (Henderson, Gilbert & Zimbardo, 2014). Gender differences have been implicated, but results are

inconsistent when social situation is controlled for (MacKenzie & Fowler, 2013). Cross-cultural differences in social anxiety have also been found: East Asia has a higher prevalence compared to other areas, for example (Schreier et al., 2010). The discomfort socially anxious people experience can seriously impact their vocational performance and social functioning, causing, for example, difficulty joining social events, establishing intimate relationships and presenting work, which can affect academic and career advancement (Liebowitz, Gorman, Fyer & Klein, 1985). These individuals also tend to avoid social situations or abuse drugs or alcohol to alleviate their anxiety and distress when they have to be in such situations (Buckner, Schmidt & Eggleston, 2006).

1.4.1.2 Social Anxiety as a Disorder

Social anxiety disorder (SAD) was officially recognised as a diagnostic entity in the third edition of the DSM-III (DSM-III; American Psychiatric Association, 1980). Its relatively late addition to the official psychiatric nomenclature was due to insufficient disability and high comorbidity with personality disorder (Iancu et al., 2011). Clinical and epidemiological research on SAD dramatically increase thereafter, and it was recognised as the third most common psychiatric disorder in the US after major depression and alcohol dependence (Kessler et al., 2005). The lifetime prevalence of SAD is 5 to 12% in the general population, the most common period of onset is during adolescence (ages 14 to 17), and the mean duration is 16.3 years. Women, individuals with low income and individuals living in rural areas were more vulnerable (Kessler et al., 2005; Cox et al., 2008; Rosellini et al., 2013). In the latest DSM (DSM-V; American Psychiatric Association, 2013), the default term social anxiety disorder was used, and it was categorised as persistent and intense fear and avoidance of social or performance situations in which embarrassment or humiliation may arise. Clinical interviews are most commonly used to diagnose SAD. The Anxiety Disorders Interview Schedule for DSM-IV (ADIS-IV; Brown, DiNardo & Barlow, 1994) and the Structured Clinical Interview for DSM-IV (SCID-IV; First, Spitzer Williams & Gibbon, 1997) are the most commonly used structured interviews. The Liebowitz Social Phobia Scale (LSPS; Liebowitz, 1987) is recommended as the most popular clinician-rated assessment instrument in clinical trials of SAD, and has been increasingly used in a self-report format. Social Phobia and Anxiety Inventory (SPAI; Turner et al., 1989) is another popular self-report

measure to assess the critical features of SAD. The Social Phobia Inventory (SPIN; Conner et al., 2000) is a self-report measure that includes an interview-based scale, the Brief Social Phobia Scale (BSPS; Davidson et al., 1991), an assessment specific to the physiological symptoms of social anxiety. Individuals diagnosed with SAD scored high on cognitive vulnerability, including attention bias (Yiend & Matthews, 2001; MacLeod et al., 2002; Sposari & Rapee, 2007; Van Bockstaele et al., 2014; Heeren et al., 2015), interpretation bias (Stopa & Clark, 2000; Wilson & Rapee, 2005; Huppert et al., 2007; Beard & Amir, 2010) and memory bias (Mitte, 2008; LeMoult & Joormann, 2012). A substantial comorbid psychopathology was also found (Ruscio et al., 2008): 20–50% of patients also had substance dependence disorders (Buckner et al., 2013; Cogle et al., 2015) and more than 50% had at least one other anxiety disorder (Ohayon & Schatzberg, 2010; Raffray & Pelissolo, 2011). Social anxiety disorder frequently co-occurred with major depression, also a significant risk factor for the subsequent onset of major depression (Beesdo et al., 2007; Stein & Stein, 2008). A high prevalence of Axis II disorders, especially avoidant personality disorder, was also found in this population (Grant et al., 2005). The high comorbidities and lack of treatment lead to functional impairment and negative outcomes, including damaged self-esteem, impaired relationships, isolation, financial dependency and suicidal ideation (Crozier & Alden, 2001; Ruscio et al., 2008).

1.4.2 Cognitive Theories of Social Anxiety

Mechanisms that determine and maintain fears and anxieties are fundamental to understanding the psychopathology of social anxiety disorder. Various theories and models have been proposed to explain these mechanisms, from the physiological to the psychological. Here, the focus is on cognitive approaches that can be incorporated into theories of social anxiety disorder.

Contemporary models proposed by Clark and Wells (1995) and Rapee and Heimberg (1997) have been widely used to explain the cognitive mechanism of social anxiety. Other productive theories and frameworks have recently been proposed (Hofmann & Barlow, 2002; Kimbrel, 2008; Moscovitch, 2009). In this chapter, the focus is on biased information processes, especially biased interpretation and its equivalents. To better understand how interpretation bias works, each model is summarised separately.

1.4.2.1 Clark and Wells

The key component of the cognitive behavioural model proposed by Clark and Wells (1995) is the function of interoceptive information, when socially anxious individuals try to construct internal evaluations. Using interoceptive information, they possess a range of beliefs and assumptions, including excessively high standards of social performance (e.g., "I must always attract others' attention"), negative self-evaluations (e.g., "I am weird"), and negative social evaluations (e.g., "People think I am weird and avoid me because I am quiet"). These beliefs and assumptions function cyclically across stages: prior to, in and after social situations. Before entering social situations, socially anxious individuals have already developed anxious symptoms, based on a series of negative assumptions. They automatically recollect early poor experiences, appraise social situations as threatening and make negative predictions about their future performance. On entering social situations, by combining past experiences and interoceptive information, they maintain their negative beliefs about the social situation and themselves. They believe social situations are threatening and perceive their own behaviours as inappropriate or unfavourable, and for which others will judge or reject them. They evaluate themselves with a high 'self-focus attention' (Clark & Wells, 1995, p. 72), shifting their attention from social interaction to self-observation, which they monitor with their interoceptive information (e.g., distorting observable self-image in mind). To reduce the negative evaluations of others and prevent feared catastrophes, socially anxious individuals engage in a series of 'safety behaviours' (Clark & Wells, 1995, p. 73), such as keeping quiet to avoid saying something stupid, which in fact increase the chance of feared catastrophes, as others may perceive them as unfriendly or provoked when they look distant or uninterested as a result of focusing too intently on self-monitoring. In addition, safety behaviours maintain negative beliefs, as the socially anxious attribute the non-occurrence of feared catastrophes to their safety behaviours rather than to their own abilities. After escaping social situations, socially anxious people feel their anxiety decline immediately; however, the processing of interoceptive information continues. Interactions are selectively retrieved in detail, concluded to be more negative than they actually are, and encoded in memory. Predictions of future performances

are based on recalling the memory when next entering social events. These steps maintain a close cycle of social anxiety, causing socially anxious people to avoid social interaction.

1.4.2.2 Rapee and Heimberg

Rapee and Heimberg (1997) use the term “audience” to describe anyone who may perceive the appearance or behaviour of socially anxious people. According to their model, biased cognition processes are important in generating and maintaining social anxiety. The notion that socially anxious individuals perceive others as evaluating them negatively was also emphasised. However, these processes are similar, regardless of which stages of social interactions socially anxious individuals actually encounter. At each stage of social event, socially anxious individuals allocate attention to the 'mental representation' (p. 742) of their self-image as seen by others, and to potential external evaluations. They then estimate the probability of receiving negative evaluations by comparing internal representations with appraisals of the audience's expected standard. This cycle maintains the anxiety and progresses symptoms from cognitive behavioural to physical.

1.4.2.3 Other Cognitive Theories

The psychological maintenance model proposed by Hofmann (2007) extended previous theories by emphasising central elements of social mishap and mistake-rumination. He proposed that socially anxious individuals tend to interpret neutral social situations as mishaps, because they perceive their social skills negatively and overestimate the negative results of their social engagements. They commonly avoid or use safety behaviour to avoid social mishaps. However, both strategies involve processing and mistake-ruminations, which disturb social interaction, leading to more mistakes and further anticipation of social mishap.

Kimbrel (2008) proposed a unified model, integrating a wide range of factors from biological and environmental to cognitive. The model suggested that shyness or an inhibited temperament is a key aetiological factor in social anxiety. Cognitive bias towards socially negative information mediated the effect of behaviour inhibition style on social anxiety when anticipating socially threatening scenarios. Biased processes interact with perceptions of social threat, contributing to the maintenance of negative beliefs and expectancies.

Moscovitch (2009) conceptualised the core fear of social anxious patients as exposure of self-attributes, which they believe are deficient according to the social expectations of potential observers. Socially anxious individuals perceive flaws in their social skills and performance, in concealing their anxious symptoms, in their general appearance and character. The author suggests that focusing on each of these concepts might facilitate pre-treatment assessment and enhanced treatment outcomes.

Pescharda and Philippota (2015) proposed a conceptual framework for social anxiety with working memory as its central concept (Clark & Wells, 1995; Rapee & Heimberg, 1997). In this framework, attentional control interacts with factors like task goals (e.g., high self-standard for social performance), stimulus salience (e.g., critical verbal insults), selection history (e.g., effects of information in recent experience) and long-term memory to determine which content enters working memory. Furthermore, biased attention leaves limited resources to monitor neutral information, exacerbating the tendency to form biased memories of social threatening information. Memory biases may then work back to the cycle by heightening sensitivity to social threats, that maintain social anxiety.

In summary, different cognitive theories are consistent with the significance of biased information processing in maintaining social anxiety disorder. Interpretation, attention and memory are the key mechanisms of these theories. However, theories have not yet reached consensus on content specification of biased information processing. Furthermore, biased information processing does not contribute to social anxiety in the same way in all models. Finally, it is unclear whether biased processing happens at all or only at certain stages of information processing.

In the next section, the empirical evidence for biased information processing, with a special focus on biased interpretation and evaluation of cognitive behavioural approaches to social anxiety disorders, are summarised and discussed.

1.4.3 Interpretation Bias in Social Anxiety

There is ample evidence that interpretation bias is closely related to social anxiety. Verbal social ambiguities displayed in homographs (e.g., Amir, Beard & Przeworski, 2005), sentences (e.g., Beard & Amir, 2010; Amir, Prouvost & Kuckertz, 2012) and scenarios (e.g.,

Stopa & Clark, 2000; Hirsch & Mathews, 2000; Huppert et al., 2007) are the most common strategies used to examine interpretation bias in social anxiety. The major finding of these studies is that socially anxious individuals experience and interpret social information negatively, but to different degrees. Early results indicated that community volunteers interpreted socially threatening information in emotionally congruent ways (Hirsch & Mathews, 1997). The same applies in clinical settings (Amin et al., 1998). Participants were presented with social scenarios, each followed by positive, negative and neutral interpretations, and were asked to rank them according to likelihood. Socially anxious individuals made more negative than positive interpretations, but only in self-relevant scenarios, suggesting an interpretation bias for self-related social information in social anxiety as opposed to anxiety disorders in general. These results were replicated in studies that measured interpretation bias by ratings of ambiguous or threatening social information (Stopa & Clark, 2000; Huppert et al., 2003; Voncken, Bogels & Vries, 2003; Wilson & Rapee, 2005) and positive social information (Vassilopoulos, 2006; Laposa, Cassin & Rector, 2010). Interpretation biases ranged from negative to catastrophic in response to how socially threatening were the presented scenarios (Stopa & Clark, 2000). In addition to negative interpretation bias, socially anxious individuals also tend to provide fewer benign and positive interpretations than non-socially anxious individuals (Amir et al., 2012, 2012; Constans et al., 1999; Hirsch & Mathews, 2000; Huppert et al., 2007).

Ecologically non-verbal stimuli have also been commonly used to demonstrate interpretation bias in socially anxious individuals. Emotional facial expressions (EFE) are the most widely used. Socially anxious individuals were able to identify EFE as accurately as non-socially anxious individuals, without interpretation bias (Philippot & Douilliez, 2005; Schofield et al., 2007, 2007). However, they were more sensitive to angry face cues in ambiguous pictures. For example, Richards et al. (2002) used computer-manipulated images of six blended facial expressions ranging from happiness to anger (happiness, surprise, angry, fear, disgust and sadness). Different proportions of happy or angry expressions were presented to each participant for classification. Results showed that socially anxious individuals categorised more ambiguous faces as expressing fear than did non-socially anxious individuals. Similar results were found in other studies (Joormann & Gotlib, 2006; Kuckertz & Amir, 2015), by

using different methodologies, such as by testing reaction/response time (Yoon & Zinbarg, 2008), by showing lack of positive bias in socially anxious individuals (Moser et al., 2008), by employing positive facial expressions (Heuer, Rinck & Becker, 2007), and by providing a crowd of faces in each single trial (Douilliez et al., 2012). The findings were replicated in a clinical sample (Mohlman, Carmin & Price, 2007). Amir, Beard and Bower (2005) investigated interpretation bias using videos of an actor or actress approaching the audience and commenting on the audience. Participants were asked to rate the emotional valence of each video; how they would feel in each situation. Results revealed that socially anxious individuals rated the valence of ambiguous social interactions more negatively than did non-socially anxious individuals.

Socially anxious individuals thus tend to interpret ambiguous, social information negatively. These biases emerge in response to both semantic and vivid expression stimuli, when stimuli are restricted to socially relevant information.

1.5 Interpretation Bias in Social Anxiety and Psychosis

1.5.1 Links between Social Anxiety and Psychosis

31% of first-episode psychosis patients meet the criteria for social phobia. Although social phobia and paranoid disorders are organised under two separate categories in the DSM-V, empirical evidence suggests an aetiological overlap in both the clinical and general population (Gilbert et al., 2005; Rietdijk et al., 2009). Social phobia is conceptualised as a co-morbid or prodromal symptom of schizophrenia (Cassano et al., 1998; Pallanti et al., 2004). They might share common psychological cognitive processes (Beck et al., 1985; Fenigstein & Vanable, 1992) and paranoid ideation might precede the development of social phobia (Rietdijk et al., 2009). Social anxiety can be the result of a psychotic episode (Birchwood et al., 2006).

Paranoid thinking and anxiety-related processes are linked. Patients with social anxiety disorder sometimes report psychotic-like experiences (Gilbert et al., 2005). The role of anxiety in psychosis has been increasingly recognised (Freeman et al., 2005a; Fowler et al., 2006; Johns et al., 2004; Martin & Penn, 2001). Anxiety contributes to the formation of

thoughts with paranoid content, maintaining the distress associated with paranoia (Freeman et al., 2001; Freeman & Garety, 2000). A close relationship has been established between social anxiety and paranoia (Martin & Penn, 2001; Johns et al. 2004; Freeman et al. 2008). Social anxiety and paranoia share many of the same predictive factors, such as interpersonal sensitivity (negative beliefs about self and others), social evaluative concerns and socially phobic behaviour (Freeman et al., 2008). Nevertheless, social anxiety and paranoia differ experientially (Freeman et al., 2008) and the direction of these causal factors predict their nature and extent. Socially anxious individuals are afraid of negative evaluation, whereas paranoid individuals are afraid of persecution (Rietdijk et al., 2009). In a virtual reality study, Freeman et al. (2008) found that the anticipation of threat increased the risk of paranoid reactions but decreased the risk of social anxiety. The identification of causal factors that predict these experiences suggests the possibility of differentiating pathology. A key impetus of this study is therefore to identify which aetiological factors distinguish social anxiety from paranoia.

1.5.2 Interpretation Bias in Social Anxiety and Psychosis

Disorder-congruent information processing bias is aetiologically significant. It involves selectively prioritising cognitive processing, thus maintaining pathological beliefs. Of particular interest is selective attention, which contributes to developing and maintaining social anxiety (Mathews & MacLeod, 1994; Beck et al., 1979; Mogg & Bradley, 1988; Eysenck, 1992) and psychotic disorders (Morrison, 2001; Mackintosh et al., 2006). It is a tendency consistently to favour a particular stimulus. According to the literature, the tendency is to interpret ambiguous information as less positive, negative or threatening (Butler & Mathews, 1983, Mathews & Mackintosh, 2000; Wilson et al., 2006). In the classical cognitive model (Beck, 1964), it affects the way individuals label and recognise salient features of information, contributing to one's beliefs and attitudes and determining responses to events. More specifically, an interpretation style might reflect a characteristic emotional trait (Mathews & Mackintosh, 1998). Anxiety and psychosis are arguably each characterised by a cognitive bias, which differs in content. Anxious individuals prefer to process anxiety-related stimuli (anticipation of threat) (Clark & Wells 1995), whereas psychotic individuals prefer the paranoid-related stimulus (anticipation of persecution) (Freeman, 2007).

Identifying causal factors that differentially predict these experiences suggests the possibility of different underlying pathologies. There are as yet no studies on interpretation bias in social anxiety and psychosis. Paranoia is accompanied by a feeling of oddness that may lead to interpreting stimuli as threatening (Freeman et al., 2008). Interpretation bias has long been associated with social anxiety. For instance, individuals may overhear someone whisper when they pass them in a corridor. From the many possible interpretations of this scenario, anxious individuals tend to be biased towards making a negative interpretation, such as 'they are gossiping about me'. In contrast, non-anxious individuals may interpret it as, 'they are just chatting'. Interpretation has been widely studied, based on the hypothesis that anxious individuals will interpret ambiguous information in a more threatening way.

1.6 Study Aims

This aim of this study is to investigate the relationship between interpretation bias, social anxiety and paranoia. The hypothesis is that different styles of interpreting emotionally ambiguous information are causally associated with specific symptomatology and pathology emerges. For example, an interpretation that assumes intent of harm (e.g., seeing two people whispering while looking at you means, 'they are plotting against me') is likely to precipitate negative paranoid thoughts, possibly ultimately persecutory delusions. Conversely, the same ambiguity may be interpreted to mean that others are subjecting one to negative evaluation (e.g., seeing two people whispering while looking at you means, 'they are talking about my faults'). This is likely to precipitate socially anxious thoughts, and possibly ultimately social anxiety disorder.

1.7 Outline of Current Experiments

This thesis consists of five experiments, which are designed to test different aspects of the hypothesis: one longitudinal study (incorporating two separate experimental questions) plus three cross-sectional studies (one of which recruited a large clinical sample of patients with social anxiety disorder, paranoid psychosis and non-paranoid psychosis, as well as healthy controls). A range of tests of interpretation bias were administered to improve the validity of the findings (specifically, the Similarity Ratings Task, the Scrambled Sentences Task and the

Word-Sentence Association Paradigm) and a number of self-report measures of social anxiety and paranoia traits, as well as clinical diagnostic interviews for the patient samples.

In Experiment 1 (n=84), the form and strength of the associations between the hypothesised different types of interpretation bias (socially anxious resolutions/paranoid resolutions) and the traits of social anxiety versus paranoia were examined. A significant association between different types of interpretation bias and their content-specific emotion traits was anticipated. The negatively evaluated (socially anxious resolutions) interpretation bias will be more strongly associated with social anxiety than the persecutory (paranoid resolutions) interpretation bias. Conversely, the persecutory (paranoid resolutions) interpretation bias will be more strongly associated with paranoia than the negatively evaluated (socially anxious resolutions) interpretation bias.

Experiment 2 (n= 80) is an extension of Experiment 1. The task design is altered in order to directly contrast paranoid and socially anxious interpretations (rather than contrasting paranoid versus non-paranoid and socially anxious versus non-socially anxious interpretations). Under this forced-choice experimental design, a significant association between persecutory interpretation and its content-specific emotion (paranoia) is anticipated, as well as a significant association between negatively evaluated interpretation and its content-specific emotion (social anxiety).

Experiment 3 (n = 71) is a longitudinal follow-up study, for which Experiment 1 served as the baseline. This study tests whether content-specific interpretation bias predicts corresponding traits six months later, as an indirect test of the causal role of interpretation bias in precipitating social anxiety and paranoia. We expect negatively evaluated interpretation bias to predict subsequent social anxiety traits, and persecutory interpretations to predict subsequent paranoia traits. Moreover, the interaction effects between the two types of bias in predicting corresponding trait emotions (social anxiety/paranoia) will be tested.

In Experiment 4, a combination of existing data and new data collected over a six-month period is used to test the hypothesis of reciprocal causality (do traits exacerbate congruent bias in addition to bias-maintaining traits, such that a vicious cycle is established?). The data

is expected to be consistent with this model in the case of trait social anxiety and its congruent biases, and in the case of trait paranoia and paranoid bias.

In Experiment 5, a large clinical sample and healthy controls ($n = 102$) will be recruited to examine questions similar to those in the previous subclinical samples. A pattern broadly consistent with content-specific interpretation bias in both social anxiety and paranoid psychotic patients was anticipated.

Chapter 2 Experiment 1: Investigation of Interpretation Bias in Social Anxiety and Paranoia

2.1 Experiment Overview

There is evidence that the psychological mechanisms of social anxiety and paranoia overlap (Gilbert, Boxall, Cheung & Irons, 2005). Both socially anxious and paranoid individuals feel vulnerable (Salvatore et al., 2012) and make biased, emotionally ambiguous interpretations (Beck, Emery & Greenberg, 1985; Fenigstein & Vanable, 1992). While the two disorders share a common aetiology, they are, however, driven by different motives (Rietdijk, Van Os, Graaf, Delespaul & Gaag, 2009). The socially anxious fear negative evaluation, whereas the paranoid fear persecution. Biased interpretations are of aetiological significance in both, and contribute towards maintaining the disorders (Amin, Foa & Coles, 1998; Bentall et al., 2009; Freeman, Garety, Kuipers, Fowler & Bebbington, 2002; Hirsch & Clark, 2004; Morrison, 2001; Stopa & Clark, 2000). Using a cross-sectional design and a broad population, the association between biased interpretations in social anxiety and paranoia is examined in this experiment. Biased interpretations are tested using three cognitive experimental tasks. Each task consists of socially anxious congruent/benign and paranoid congruent/benign content. A typical ambiguous situation might be a stare from a stranger or strangers. Socially anxious congruent indices are conveyed by presenting this ambiguous situation in a sentence; for example, "the strangers are gossiping about me". Paranoid congruent indices are conveyed by presenting the situation by means of a suspicious sentence, "the stranger is stalking me". Regression analyses are used to examine the predictive value of interpretation bias in social anxiety and paranoia.

2.1 Background

Social anxiety refers to negative beliefs about the threatening evaluations of others (Mattick & Clarke, 1998). Paranoia involves persecutory beliefs about being threatened or harmed by others (Freeman, Garety & Phillips, 2000). They both concern threats and interpretation processes in identifying threats. According to both cognitive models of social anxiety and

paranoia, vulnerability is maintained by interpreting emotional ambiguities as threatening. First, biased interpretations occur as pre-existing anomalous beliefs to deal with ambiguous situations (Close & Garety, 1998; Amir, Prouvost & Kuckertz, 2012). For example, in the situation when entering a party without receiving attention, socially anxious individuals with beliefs such as “I am boring” might interpret this as they are being boring, whereas paranoid individuals with beliefs such as “I am isolated” might interpret this as others being suspicious of them. Rather than producing biased interpretation based on external feedback at the time of an actual social event, vulnerable individuals often report stereotyped, pre-existing interpretations. Second, confusion and emotional changes typically accompany these interpretations, and drive a search for the meaning of such emotional ambiguities (Garety & Freeman, 1999). For example, in the same situation, both types of vulnerable individuals may feel anxious and self-conscious. Such negative feelings increase the tendency towards biased interpretations and avoidance behaviours at social events, leading to confirmatory evidence and maintenance of threatening beliefs. To our knowledge, these biases have not yet been empirically distinguished, as the two are measured separately without comparisons (Amir, Prouvost & Kuckertz, 2012; Savulich, Freeman, Shergill & Yiend, 2015). A paradigm that measures both negative (social anxiety indices) and suspicious (paranoia indices) interpretations would differentiate between the two interpretation biases.

Most interpretation paradigms have been developed in order to study emotional disorders, generally distinguishing between interpretations based on pre-existing beliefs (Hirsch & Mathews, 2000). Interpretations are made when emotional ambiguities are first encountered. Paradigms usually measure pre-existing interpretation by using recall or question answering. Typically, ambiguous information is presented (e.g., scenarios), followed by possible interpretations. Participants are asked to respond to a range of interpretations in different ways, for example by rating how closely the interpretations relate to the scenarios, (Eysenck, Mogg, May, Richards & Mathews, 1991), or by ranking the accuracy of alternative interpretations in relation to emotional ambiguities (Stopa & Clark, 2000). The Similarity Rating Task (SRT; Eysenck et al., 1991) is the classical paradigm used to measure interpretation bias, established in anxiety studies. The researchers presented groups of participants, who ranged from none to severe on a social anxiety measure, with ambiguous

scenarios that could be understood in a negative or a positive way; for example, "Your boss asked you for a talk". Alternative extensions of these sentences are generated, rendering them unambiguously threatening or relatively positive (e.g., by referring to being promoted versus being fired). Participants then rated how consistent the interpretations were with the original sentences. The results of the two SRT experiments (Eysenck et al., 1991) indicated that anxious participants showed more negative beliefs on socially ambiguous scenarios than healthy controls; their biased interpretation reflects their anxious mood. This is the only task so far used in both social anxiety and psychosis studies. The SRT allows interpretation bias and response bias to be separated, validating the difference in interpretation bias between vulnerable individuals and healthy controls. However, experimental material matching other emotional information is limited, and the non-threatening can be subdivided into precise subtypes (e.g., positive or benign). To test the pre-existing beliefs on interpretation processes, Beard and Amir (2010) developed the Word Sentence Association Paradigm (WSAP) for a study on social anxiety. They presented possible interpretations before the ambiguous stimuli. Threatening (e.g., avoid) and benign (e.g., greet) primes were displayed first, followed by ambiguous sentences (e.g., you see a group of people approaching). This design imitates the priming effects of pre-existing interpretations. In addition to the self-report, Beard and Amir (2010) included a measure of reaction time, which was recorded to indicate how quickly a participant accepted or rejected a priming interpretation. A biased interpretation style was observed in reaction time and self-report data. This was the first comprehensive paradigm of interpretation bias to measure both self-report and reaction time. Reaction time records the time participants spend on determining how the prime and ambiguous stimuli relate. The Scrambled Sentence Task (Wenzlaff & Bates, 1998) elicits the initial interpretations of ambiguous information. The SST is well established and widely used in depression studies. Its reliability in both clinical and subclinical populations has been established. Participants are presented with strings of six words (e.g., interesting me people boring other find) and asked to unscramble them to form five-word statements. The valence of the statement can be positive (e.g., other people find me interesting) or negative (e.g., other people find me boring). In addition, participants are asked to memorise a six-digit number while unscrambling the words. The hypothesis is that,

the more an individual suppresses negative interpretations, the more they will produce interpretation bias. The results of a recent SST study (Savulich et al., 2015) revealed a negative interpretation bias in individuals with paranoia. The SST is the most sensitive measure for testing interpretation in paranoia. Memorising numbers during the task ostensibly reduces the cognitive distraction of unwanted thoughts. It is arguably difficult, however, to identify the cognitive processes active in SST. The selection of words is possibly due to an attention bias. Most studies focus only on one type of the interpretation bias. Using measurements in multiple dimensions will ensure that our experiment covers all stages of biased interpretation processing. Our results will be enhanced if different tasks yield similar results and using various tasks helps balance the strengths and limitations of each. For example, using SST will ameliorate the limitation of SRT: its relatively exclusive focus on interpretation biases. This allows a broader scope of cognitive processes to be tested.

In the current experiment, we assessed interpretation bias in both social anxiety and paranoia using three paradigms: the Similarity Rating Task (SRT), the Word Sentence Association Paradigm (WSAP) and the Scrambled Sentences Task (Husstedt et al., 2002). This design differs from previous studies in three ways. First, it includes both a social anxiety and a paranoia related content in each cognitive paradigm. This allows content specificity to be tested, as well as two interpretation biases to be compared in terms of their corresponding symptoms. Content specificity in interpretation bias is related to biases in favor of one's emotional concerns, matching core psychopathological traits (e.g., interpreting ambiguous social events as negative, exacerbating social anxiety) (Mathews & MacLeod, 1994). Second, we employed measures of interpretations in multiple dimensions, allowing testing of both pre-existing stereotype interpretations and encountered interpretations in a social context. Both self-reported and reaction time measures are included, allowing implicit measurement of interpretation bias. Third, data is analysed not only according to the precedent set by the literature, but also according to the major research interests here. The precedent in the literature on anxiety and depression compares interpretation bias in individuals with different emotional traits. This is a typical design, directly testing the existing cognitive theory of social anxiety, according to which socially anxious individuals produce more negative (trait-matched) interpretation bias than do healthy controls. In this design, the

emotional trait is used as the independent variable, in order to test how it relates to interpretation bias. The aim in the current thesis is to confirm whether the current results are consistent with previous findings in the literature. The proposed aetiological role of interpretation bias has been developed from the following theoretical rationale: if emotionally vulnerable individuals differ in interpretation bias, the direction of interpretation bias may predict the potential bias-congruent emotional trait. In the current thesis, the major research interest is the aetiological importance of interpretation bias in identifying corresponding emotional traits or symptoms. Although we are unable to test the aetiological role of interpretation bias in the current cross-sectional setting, we will investigate separately the association of interpretation bias in relation to the social anxiety and paranoia traits.

Our hypothesis is stated in two parts:

Part 1: Testing the precedent in the literature: there is a direct, content-specific association of emotional traits towards trait-congruent interpretation bias

- I. Social anxiety is more strongly associated with the negatively-evaluated (social anxiety congruent content) interpretation bias than paranoia
- II. Conversely, paranoia is more strongly associated with the persecutory (paranoia congruent content) interpretation bias than social anxiety.

Part 2: Testing the major research interest of the project: there is content-specific association of interpretation bias towards its content-congruent emotional traits.

- III. The negatively-evaluated (social anxiety congruent content) interpretation bias is more strongly associated with social anxiety than the persecutory (paranoia congruent content) interpretation bias.
- IV. Conversely, the persecutory (paranoia congruent content) interpretation bias is more strongly associated with paranoia than the negatively-evaluated (social anxiety congruent content) interpretation bias.

2.2 Methods

2.2.1 Experiment Design

We tested individuals with a wide range of scores on social anxiety and paranoia using a battery of self-report personality measures and tests of interpretation bias. In order to measure interpretation biases for socially-ambiguous information ("negative evaluation") versus paranoia-relevant information ("persecution"), three cognitive experimental tasks (the Scrambled Sentences Task (SST), the Similarity Rating Task (SRT) and the Word-sentence Association Task (WSAP)) were developed, each containing material reflecting both types of content.

2.2.2 Participants

84 non-clinical volunteers (59 female, 25 male) were eligible for participation and completed all experiment procedures. Participants consisted mainly of students and staff at King's College, London, and were recruited by circular email after meeting inclusion criteria for the study. The inclusion criteria were (a) being over 18 years of age, (b) fluent in English and (c) not having been diagnosed with any psychological or psychiatric disorder and not currently receiving treatment for any psychological or psychiatric disorders, including psychopharmacological medication. Participants were predominantly Caucasian ($n = 54$), with the sample also including participants of Asian ($n = 10$), Black/African/Caribbean ($n = 8$) and other ($n = 12$) origins. Ages ranged from 18 to 60 years ($M = 29.06$, $SD = 12.22$). The educational attainments of participants ranged from high school ($n = 14$) to university ($n = 69$); only one participant indicated "other".

2.2.3 Recruitment

This study was approved by the Psychiatry, Nursing & Midwifery Research Ethics Subcommittee. Ethical conduct was adhered to, as laid out in the King's College London Guidelines on Good Practice in Academic Research. Recruitment began in June 2011 and lasted for four months. Internal circular emails and posters on local public notice boards at KCL were used. Volunteers were sent a study information sheet, and completed a recruitment questionnaire, which included contact details, demographic information and two mood questionnaires: the Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998)

and the Self-report Paranoia Scale (Fenigstein & Venable, 1992). Inclusion criteria were to be fluent in English and aged between 18 and 60 years. The exclusion criterion was currently receiving or having previously received treatment or counselling for mental health problems. Participants with a wide range of scores on the mood questionnaires were selected. Eligible volunteers were invited to participate in the study using the contact details provided.

2.2.4 Materials

2.2.4.1 Measures of Emotional Trait

A thorough literature review was conducted to identify measures of social anxiety and paranoia. We reviewed instruments used in same area of research, checking whether items suited the specific needs of this study, including the specific population and psychological mechanism under study. Five social anxiety measures and three paranoia measures were finally selected. These were designed to measure the relevant emotional traits, were sensitive to the relevant population and were suitable in length.

Measures of social anxiety

Fear of Negative Evaluation Scale (FNE) and Social Avoidance and Distress (SADS) Scale (Watson & Friend, 1969) These two scales were developed to measure the exclusion criteria of two constructs reflecting social evaluative anxiety: the FNE, which included 30 true/false items assessing the expectation and distress related to the negative evaluation of others. The Cronbach alpha rating for the internal reliability of FNE was 0.94 to 0.98; the test-retest reliability, 0.78 to 0.94 (Watson & Friend, 1969). The SADS consists of 28 true/false items, which assess distress at and avoidance of social situations. The SADS is highly reliable in college students, with an internal consistency of 0.94 and test-reliability of 0.68 (Watson & Friend, 1969).

Social Interaction Anxiety Scale (Ayaso-Arriola et al.) and Social Phobia Scale (SPS) (Mattick & Clarke, 1998) The SIAS is composed of 20 items and scored on a five-point scale: 0 (not at all characteristic of me) to 4 (extremely characteristic of me). It assesses anxiety at initiating and maintaining interactions with people in social situations. The SPS is designed to assess anxiety symptoms related to performing various tasks (writing, drinking,

eating in public) while observed by other people. It consists of 20 items. Each SPS item is rated on a five-point scale ranging from 0 (not at all characteristic or true of me) to 4 (extremely characteristic or true of me). The SIAS and SPS have good internal consistency, with a Cronbach alpha rating of 0.88 to 0.94 and test re-test reliability of 0.92 and 0.93 (Mattick & Clarke, 1998). Correlation coefficients with scores on other social anxiety indices ranged from 0.53 to 0.77, and the convergent validity of SIAS was moderate to strong (e.g., Hughes et al., 2006; Mattick & Clarke, 1998),

Liebowitz Social Anxiety Scale (LSAS, Liebowitz, 1987) This measure is used to screen participants for social anxiety disorder, and has been widely used to assess a full range of performance and social difficulties. It includes two subscales, producing indices of fear and avoidance of social interaction (11 items) and performance (13 items). Each consists of a four-point scale ranging from 0 to 3. Scores represent how participants have felt during the past weeks, with higher scores indicating greater anxiety. Its internal consistency and re-test reliability are excellent, at 0.95 to 0.98 (Heimberg et al., 1999; Masia-Warner et al., 2003) and 0.92 (Mattick and Clarke, 1998), respectively. Good convergent validity has also been found (Heimberg et al., 1999; Masia-Warner et al., 2003).

Measures of paranoia

Green et al. Paranoid Thought Scales (GTPS, Green et al., 2008) This scale consists of two subscales that assess ideas of social reference and ideas of persecution rated on five-point Likert-type scales, from 1 (Not at all) to 5 (Totally). Four items from each dimension (conviction, preoccupation and distress) were chosen and four items simply reflecting a statement of a paranoid thought. Cronbach alpha values for the GTPS are 0.83 in the non-clinical population and 0.82 in the clinical population (Green et al., 2008). Convergent validity with scores of other paranoia measures ranged between 0.43 and 0.71 in non-clinical samples and 0.39 and 0.81 in clinical samples (Green et al., 2008).

Self-report Paranoia Scale (PS, Fenigstein & Vanable, 1992) This scale was designed to measure the incidence of paranoia in a non-clinical college population. Participants rate their agreement with each of 20 items on a five-point scale (1 - not at all applicable, 5 - extremely applicable). Scores can range from 20 to 100, with higher scores indicating

greater paranoid ideation. It is the most widely used dimensional measure of paranoia. The Cronbach alpha of the PS ranged from 0.81 to 0.87 across four non-clinical samples between 1985 and 1988, indicating a substantial degree of internal consistency. Its test-retest reliability was at 0.70, indicating good stability (Fenigstein & Venable, 1992). The convergent validity of the PS with the Paranoia checklist ranged from 0.58 to 0.71 (Freeman et al., 2005).

Peters Delusions Inventory (PDI; Peters et al., 1999) This inventory is used to assess delusional ideation in the non-clinical population on a behavioural measure, including measures of distress, preoccupation and conviction. In non-clinical samples, Cronbach's alpha for the PDI ranges from 0.77 to 0.82, suggesting satisfactory internal reliability (Jones & Fernyhough, 2007; Peters, Joseph & Garety, 2004), with a test re-test reliability ranging from 0.78 to 0.81). Convergent validity with the Delusions-Symptoms-State Inventory was estimated at 0.61 (Foulds & Bedford, 1975; Peters, Joseph & Garety, 2004).

2.2.4.2 Tasks of Interpretation Bias

The Scrambled Sentences Task (SST; adapted from Wenzlaff & Bates, 1998)

The SST used for this study was a modified version of the original task developed by Wenzlaff and Bates (1998), which assesses the tendency to interpret ambiguous information in positive or negative ways. It was commonly used in depressed populations, in which the internal reliability ranged from 0.69 to 0.79, and the validity in relation to other similar tasks was medium to high (Novovic et al., 2014). There were two sets of materials. In each set, participants were asked to rearrange a group of mixed up words. There were two possible solutions: a paranoid or benign interpretation in one set of SST, testing persecutory interpretation bias, and a socially anxious or benign interpretation in the other set of SST, testing negative interpretation bias. Participants rearrange the mixed up words, with two possible solutions: a paranoid or socially anxious interpretation. Participants unscramble five words to form grammatically correct sentences, placing a number over each of the five words to indicate the order of the words. 20 items were developed in each set. As seen in Figure 2.1, in the paranoia set, each scrambled sentence contained a word reflecting paranoia and a neutral word. In the social anxiety set, each scrambled sentence contained a

word that reflected social anxiety, and a neutral word. Responses yielded scores for social anxiety and paranoia bias. These scores were calculated based on whether participants disambiguated the sentences to form statements that matched the original sentences exactly.

Figure 2.1 Example items of SST

SST used in Exp 1	
Set 1: testing persecutory interpretation Scrambled words: feel tend I welcomed watched to ↓ I tend to feel watched - negative statement I tend to feel welcomed - benign statement	
Set 2: testing negative interpretation Scrambled words: usually most like people me dislike ↓ Most people usually dislike me - negative statement Most people usually like me - benign statement	

Note: negative statement reflected social anxiety related meaning; persecutory statement reflected paranoia related meaning; benign statement reflected a neutral meaning which most healthy population believed.

The Similarity Ratings Task (SRT, adapted from Eysenck et al. 1991)

The SRT was originally developed by Eysenck and colleagues (1991) and is arguably the most methodologically robust measure of interpretation bias (Savulich, Shergill & Yiend, 2015). Participants interpret emotionally ambiguous passages of text representing both paranoid and social anxiety scenarios. 20 ambiguous scenarios are presented and each scenario ends in a word fragment. An example of a scenario used in the task is the following:

Lecture

You are required to attend a Statistics lecture twice a week. You enjoy sitting with a group of friends you made last term. You greet them all but one of them does not answer b-ck [back].

Once the word fragment was correctly completed, participants were asked a comprehension question about the scenario ("Are you attending a lecture?"), to which they responded by pressing Y for yes or N for no on the testing computer keyboard. Following their response, a correct or incorrect answer message was displayed on the screen. In the second part of the SRT, the titles of each scenario (e.g., Lecture) were presented, with four possible interpretations: two target interpretations, in which content is relevant to the previous passage, and two foil interpretations, in which content is irrelevant to the previous passage (see Figure 2.2). The interpretations represent either positive or benign explanations of the scenarios. Participants were asked to rate how similar in meaning each sentence was to the original scenarios on a four-point scale (1 = very different in meaning, 4 = very similar in meaning). The SRT takes approximately 20 minutes to complete.

Figure 2.2 Example items of SRT

SRT used in Exp 1	
Set 1: testing persecutory interpretation	
Lecture	
You are required to attend a Statistics lecture twice a week. You enjoy sitting with a group of friends you made last term. You greet them all but one of them does not answer b-ck [back].	
1)	Your friend in the Statistics lecture is deliberately snubbing you - target persecutory interpretation
2)	Your friend did not hear you - target benign interpretation
3)	Your friend in the library is distracted you - foil paranoid interpretation
4)	Your friend in the library didn't hear you - foil negative interpretation
Set 2: testing negative interpretation	
Local pub	
You have just moved to a new area and your neighbour asks if you would like to go to your local pub that evening. When you arrive, they are not yet there. You imagine what they think about you after your earlier c-nvers-t-on [conversation]	
1)	After your earlier conversation, they probably thought you were likeable. - target negative interpretation
2)	After your earlier conversation, they probably thought you were dull. - target benign interpretation
3)	You find the new area pleasant - foil negative interpretation
4)	You find the new area unpleasant - foil benign interpretation

Note: negative interpretation reflected social anxiety related meaning; persecutory interpretation reflected paranoia related meaning; benign interpretation reflected a neutral meaning which most healthy population believed.

The word-sentence association paradigm (WSAP, adapted from Beard & Amir, 2010)

This paradigm includes both reaction time and self-report measures to assess interpretation. Participants must decide as quickly as possible whether or not a word (implying a persecutory/benign or negative/benign interpretation) related to an ambiguous sentence. Each trial consisted of four steps. First, participants observed a fixation cross in the middle of the screen, to alert them that a trial would begin. Thereafter, a word appeared in the centre of the computer screen for a certain time, followed by a sentence that appeared and remained on the screen until participants press the space bar, indicating that they have finished reading the sentence. Finally, participants were asked, "Was the word related to the sentence?" They could press #1 on the number pad to affirm or #3 to deny:

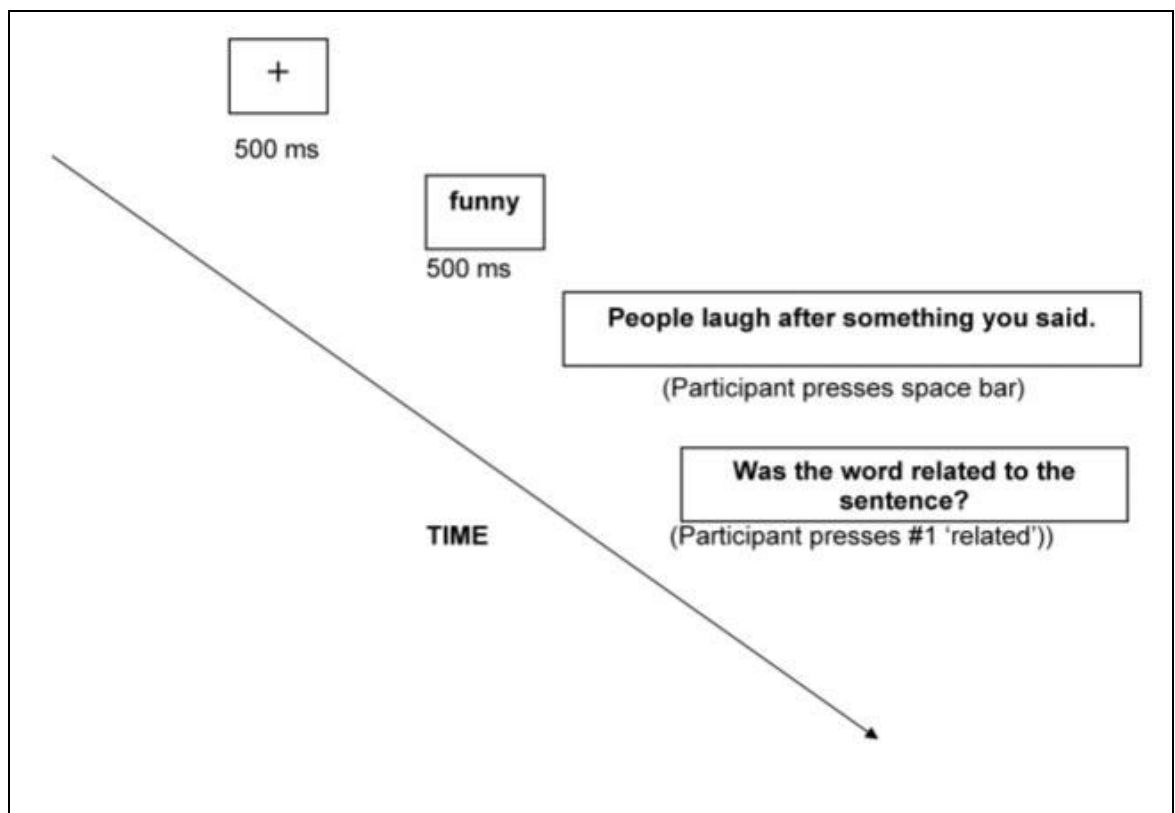


Figure 2.3 Example items of WSAP

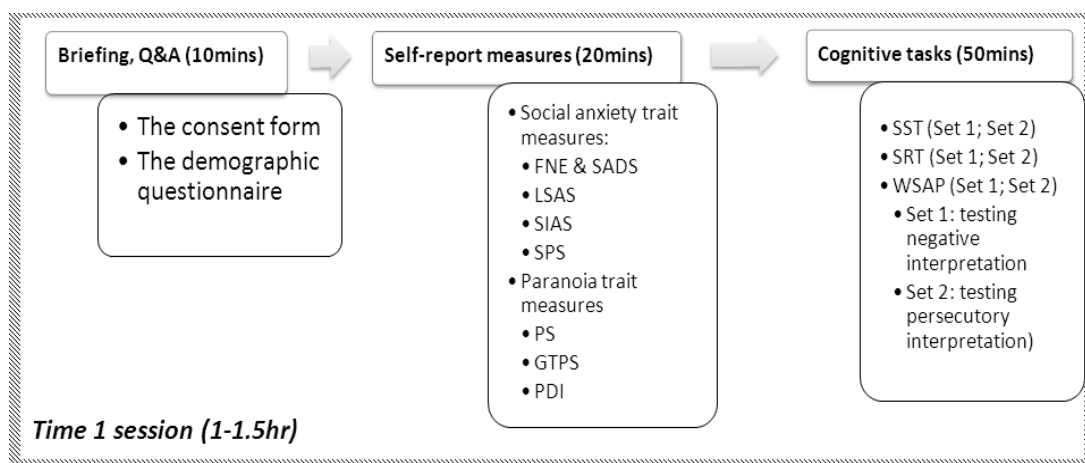
Word-sentence examples:

		Word		Ambiguous sentence
Paranoia items		<u>Mugger</u>	---- PARANOID	You can hear someone running up from behind. A friend comments on your music choice for the party
		<u>Friend</u>	---- NON PARANOID	
Social items	anxiety	<u>Disliked</u>	----NEGATIVE	
		<u>Well-liked</u>	----BENIGN	

2.2.5 Procedure

The experiment session lasted for approximately one to one-and-half hours, varying among individuals. Participants were reminded of inclusion criteria before starting. As illustrated by Diagram 1, they were then asked to complete the consent form and demography questionnaire, followed by self-report measures. This took approximately 20 to 30 minutes. Finally, to measure interpretation biases representing negative interpretation (social anxiety related) and persecutory interpretation (paranoia related), three cognitive experimental tasks were used, each consisting in two sets of materials reflecting both types of content. Two parallel versions of each task were developed and counterbalanced in order across participants. All measures were presented to participants ahead of interpretation tasks. Self-report measures and tasks were presented in two counterbalanced, fixed orders across participants. A random/counterbalanced design minimises order effects and the influence of other potentially confounding factors.

Figure 2.4 Experimental procedure



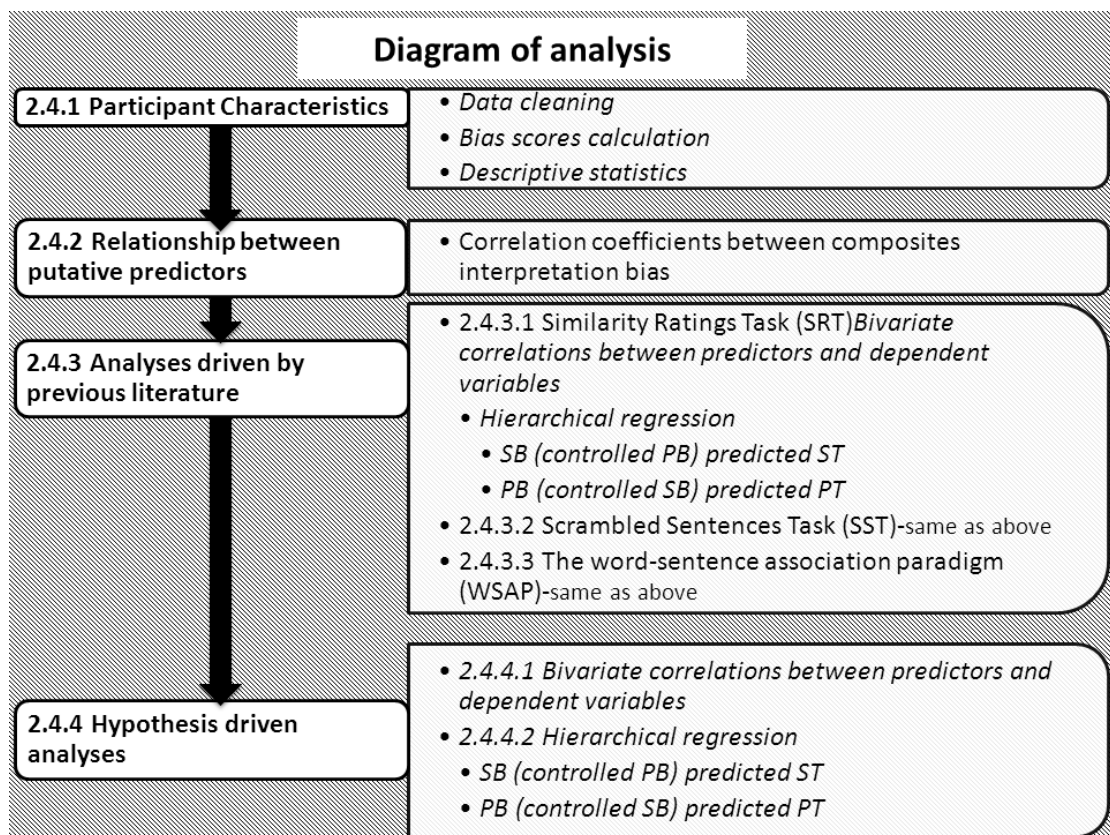
Note: The self-report measures were presented to participants ahead of tasks, and they were presented in two counterbalanced, fixed order. LSAS: Liebowitz Social Anxiety Scale (Liebowitz, 1987); SIAS: Social Interaction Anxiety Scale (Mattick & Clarke, 1998); SPS: Social Phobia Scale (Mattick & Clarke, 1998); GTPS: Green et al. Paranoid Thought Scales (Green et al., 2008); PS: Self-report Paranoia Scale (Fenigstein & Vanable, 1992); PDI: Peters Delusions Inventory (PDI; Peters et al., 1999). SRT: Similarity Ratings Task (SRT, Based on Eysenck et al. 1991); SST: Scrambled Sentences Task (SST; Based on Wenzlaff & Bates, 1998); WSAP: The word-sentence association paradigm (WSAP, Based on Beard & Amir, 2010)

2.2.6 Design of Analysis

A cross-sectional design was used. We tested participants across a wide range of scores on emotional trait measures. Our key concerns when conducting analyses included the

correlational relationships of participant ratings on three cognitive tasks measuring interpretation bias and their responses on emotional trait measures. First, raw data was analysed, following the literature. Raw scores from measures and tasks were used to determine the preliminary results of each computer-based task. Second, the composite scores based on raw data were calculated to test our hypothesis directly. Composite scores were used to enhance clarity. The results of composite score analysis should reflect the results of individual score analysis.

Figure 2.5 Analytical approach



Note: The self-report measures were presented to participants ahead of tasks, and they were presented in two counterbalanced, fixed order. LSAS: Liebowitz Social Anxiety Scale (Liebowitz, 1987); SIAS: Social Interaction Anxiety Scale (Mattick & Clarke, 1998); SPS: Social Phobia Scale (Mattick & Clarke, 1998); GTPS: Green et al. Paranoid Thought Scales (Green et al., 2008); PS: Self-report Paranoia Scale (Fenigstein & Vanable, 1992); PDI: Peters Delusions Inventory (PDI; Peters et al., 1999). SRT: Similarity Ratings Task (SRT, Based on Eysenck et al. 1991); SST: Scrambled Sentences Task (SST; Based on Wenzlaff & Bates, 1998); WSAP: The word-sentence association paradigm (WSAP, Based on Beard & Amir, 2010)

The correlation coefficients among task scores and corresponding trait scores were calculated. Further, hierarchical regression using each task score as dependent variable was

performed and their corresponding trait measure scores used as predictors. Only measures that correlated significantly with the dependent variable from the correlation analysis, were tested.

To test the hypothesis, composite scores were calculated for social anxiety and paranoia measures, and for social anxiety and paranoia related bias. We generated composites by standardising ($M = 0$, $SD = 1$) scores, then averaging them. They represented the social anxiety trait, paranoia trait, social anxiety related interpretation bias and paranoia related interpretation bias. Then, using the composites, bivariate correlation and hierarchical regression were run, to test our hypothesis directly.

2.3 Results

2.3.1 Participant Characteristics

Data cleaning

Preliminary analyses were conducted to ensure the assumptions of normality, linearity and homoscedasticity were not violated. In order to recruit participants with wide-ranging scores on all scales, only the reaction time data from WSAP was filtered. To remove the influence of outlier response times, we excluded data from trials with reaction times shorter than 50ms or longer than 1500ms. This time limitation was based upon the design of the original WSAP (Beard & Amir, 2010) and resulted in the elimination of 6.16% trials. There were 26 missing data points, which were treated by pairwise deletion. The inspection of missing data did not suggest any systematic problems with measurement tools or methods, and missing data appeared randomly distributed.

Bias scores calculation

In order to compare reaction time or rating indices with self-report indices, bias scores were calculated for social scenario sentences. Bias scores from each task were calculated using the equations listed below (see Table 2.1). Two bias scores were calculated for each task, reflecting the social anxiety and paranoia related content. Larger bias scores indicate more bias toward threat interpretations, and greater discrepancies with benign interpretations.

Table 2.1 Equations of bias scores

Task name	Bias score	Equations	Range of values
SST	Negative bias	Interpretation Bias=(Social anxiety statements/All statements completed)*100 %	0, 100
	Persecutory bias	Interpretation Bias=(Paranoia statements/All statements completed)*100 %	0, 100
SRT	Negative bias	Interpretation Bias= Mean of ratings on all Target Social anxiety -Mean of ratings on all Target Benign	-3, 3
	Persecutory bias	Interpretation Bias= Mean of ratings on all Target Paranoia -Mean of ratings on all Target Benign	-3, 3
WSAP	Negative bias	Interpretation Bias = Reaction times (Social anxiety meaning reject – Social anxiety meaning endorse)	-1500, 1500
	Persecutory bias	Interpretation Bias = reaction times (Paranoia meaning reject – Paranoia meaning endorse)	-1500, 1500

Note: negative bias represents social anxiety related interpretation; persecutory bias represents social anxiety related interpretation.

Descriptive statistics

The scores of five self-report measures (FNE, SADS, LSAS, SIAS and SPS) were used to reflect the emotional traits of social anxiety. Scores of three self-reported measures (Feinstein's PS, G-PTS and PDI) were used to reflect the emotional traits of paranoia. Scores from three tasks (WSAT, SST and SRT) represented the interpretation bias in both reaction time self-rating conditions.

Table 2.2 Means and standard deviations of trait scores and bias scores (n = 84)

Mean (SD)				
Social anxiety			Paranoia	
Emotional traits	FNE	12.20(4.50)	PS	33.55(13.02)
	SADS	6.61(6.28)	GTPS	48.60(23.28)
	LSAS	36.01(20.96)	GPTS_SocialReference	25.35(11.53)
	LSAS_Anxiety	19.54(11.09)	GPTS_Persecution	23.25(12.36)
	LSAS_Avoidance	16.75(11.08)	PDI	52.69(42.93)
	SIAS	19.74(11.94)	PDI_YesNo	6.23(4.35)
	SPS	11.36(11.02)	PDI_distress	14.29(13.23)
			PDI_preoccupation	14.46(13.42)
Interpretation bias			PDI_conviction	17.71(13.48)
	SST (%)	21.87(16.50)	SST (%)	28.08(18.03)
	SRT	1.95(0.45)	SRT	1.86(0.46)
	WSAP	27.82(115.31)	WSAP	-44.17(108.01)

Note: n=84; FNE: Fear of Negative Evaluation Scale; SADS: Social Avoidance and Distress (SADS) Scale (Watson & Friend, 1969); LSAS: Liebowitz Social Anxiety Scale (Liebowitz, 1987); SIAS: Social Interaction Anxiety Scale (Mattick & Clarke, 1998); SPS: Social Phobia Scale (Mattick & Clarke, 1998); GTPS: Green et al. Paranoid Thought Scales (Green et al., 2008); PS: Self-report Paranoia Scale (Fenigstein & Variable, 1992); PDI: Peters Delusions Inventory (PDI; Peters et al., 1999). SRT: Similarity Ratings Task (SRT, Based on Eysenck et al. 1991); SST: Scrambled Sentences Task (SST; Based on Wenzlaff & Bates, 1998); WSAP: The word-sentence association paradigm (WSAP, Based on Beard & Amir, 2010)

Means and standard deviations for each measure and task are presented in Table 2.2. To test the hypothesis that interpretation bias is more strongly associated with content-specific emotional traits and vice versa around, correlational analysis and linear regression were conducted. Rather than test the predictive role on each direction, regressions focusing on the correlational relationship of the traits and bias were conducted.

2.3.2 Relationship between Putative Predictors (trait measures)

According to Tabachnick and Fidell (1996), independent variables with a bivariate correlation of more than .80 should not be included in multiple regression analysis. Correlation coefficients between predictors in this study reveal that the constructs of social anxiety (SA) and paranoia (PA) traits are not so highly correlated that separating them is impossible. Most R values are < 0.8, meaning it is feasible to assess them as potentially different constructs and therefore different predictors.

Table 2.3 Correlation coefficients between measures of SA and PT

	FNE		SADS		LSAS		SIAS		SPS	
	r	p	r	p	r	p	r	p	r	p
GTPS	0.04	0.69	0.32*	0.003	0.53**	<.001	0.51**	<.001	0.63**	<.001
PS	0.11	0.32	0.49**	<.001	0.67**	<.001	0.65**	<.001	0.69**	<.001
PDI	0.02	0.89	0.35*	0.001	0.59**	<.001	0.52**	<.001	0.69**	<.001

Note: *p <0.05, **p <0.01, N= 79. FNE: Fear of Negative Evaluation Scale; SADS: Social Avoidance and Distress (SADS) Scale (Watson & Friend, 1969); LSAS: Liebowitz Social Anxiety Scale (Liebowitz, 1987); SIAS: Social Interaction Anxiety Scale (Mattick & Clarke, 1998); SPS: Social Phobia Scale (Mattick & Clarke, 1998); GTPS: Green et al. Paranoid Thought Scales (Green et al., 2008); PS: Self-report Paranoia Scale (Fenigstein & Venable, 1992); PDI: Peters Delusions Inventory (PDI; Peters et al., 1999).

As seen in Table 2.3, all R-values are < 0.7. It is therefore acceptable to assess social anxiety and paranoia as different constructs, and to use these as independent variables to test interpretation bias.

2.3.3 Analyses driven by Previous Literature

Consistent with previous studies of interpretation bias, hierarchical regression analyses were performed to assess the correlational relationship between interpretation bias and its content-specific trait in either social anxiety trait (ST) or paranoia trait (PT). Negatively evaluated bias (SB) reflecting socially anxious interpretation styles, while persecutory bias (PB) reflecting paranoia related meaning. From the independent variables (trait measures), only significant variables from bivariate correlation analyses were entered. The model explaining each direction of interpretation bias (SA/PA) was tested using significant variables from bivariate correlation analyses in two analyses (see Figure 2.6). In Analysis 1, the content-matched trait scores were entered as independent variables first, and the conversed (content incongruent) trait scores second. For example, in explaining the SA interpretation bias, the SA trait scores were entered in the first block and the PA trait scores in the second. In Analysis 2, the conversed trait scores were entered as independent variables first, and the content matched trait scores second. Following the example above, we entered PA trait scores in the first block, and SA trait scores in the second. Analysis 2 allowed a strength test of the trait scores, explaining content-matched interpretation bias when controlling the converse. This generated two Δ Adjusted R² values. The change of Δ Adjusted R² in the two

approaches indicates that the additional variance in the task bias scores is accounted for by the trait scores over the other. Which of the Adjusted R^2 values is greater reveals which trait scores explain the most variance in the outcome interpretation bias scores.

Figure 2.6 Analyses driven by previous literature

		Independent variables	Regression model generated	Dependent variables
Analysis 1	Step 1	Enter the content matched trait scores (e.g., SA trait)	Model 1	Interpretation bias (e.g., SB)
	Step 2	Enter the conversed (content incongruent) trait scores (e.g., PA trait)	Model 2	
Analysis 2	Step 1	Enter the conversed (content incongruent) trait scores (e.g., PA trait)	Model 3	Interpretation bias (e.g., SB)
	Step 2	Enter the content matched trait scores (e.g., SA trait)	Model 4	

Note: PAtrait=paranoia trait; SATrait=social anxiety trait; PAbias=paranoia bias; SABias=social anxiety bias

2.3.3.1 Similarity Ratings Task (SRT)

Bivariate correlations were assessed between the scores of SRT and individual trait measures. Table 2.4 shows the correlation coefficients. Of the social anxiety trait measures, only the SPS was significantly correlated with the negatively evaluated bias of the SRT. All social anxiety measures, excluding FNE, were significantly correlated with the persecutory bias of SRT. The SPS correlated most strongly with the SRT in the negatively evaluated bias. The SADS correlated most strongly with the SRT in the persecutory bias. Of the paranoia trait measures: all scores correlated significantly with both SRT score in negatively evaluated bias and persecutory bias. The PS score correlated most strongly with the SRT in the negatively evaluated bias. The PDI score correlated most strongly with the SRT in the persecutory bias. We excluded FNE from the next step of analysis.

Table 2.4 Correlation coefficients of SRT scores and trait measures

		SRT			
		Negatively evaluated bias		Persecutory bias	
		r	p	r	p
Social anxiety measures	FNE	-0.05	0.65	0.02	0.84
	SADS	0.19	0.08	0.34**	0.002
	LSAS	0.21	0.62	0.33**	0.003
	SIAS	0.16	0.17	0.28*	0.01
	SPS	0.31**	0.004	0.31**	0.006
Paranoia measures	PS	0.39**	0.03	0.24*	<.001
	GTPS	0.28**	0.009	0.36**	0.001
	PDI	0.31**	0.004	0.37**	0.001

Note, N= 82. *p <0.05, **p <0.01. Negatively evaluated bias= scores in social anxiety related meaning; persecutory bias= scores in paranoia related meaning; LSAS: Liebowitz Social Anxiety Scale (Liebowitz, 1987); SIAS: Social Interaction Anxiety Scale (Mattick & Clarke, 1998); SPS: Social Phobia Scale (Mattick & Clarke, 1998); GTPS: Green et al. Paranoid Thought Scales (Green et al., 2008); PS: Self-report Paranoia Scale (Fenigstein & Vanable, 1992); PDI: Peters Delusions Inventory (PDI; Peters et al., 1999). SRT: Similarity Ratings Task (SRT, Based on Eysenck et al. 1991)

To assess the correlational relationship between social anxiety content-specific interpretation bias and its matched traits, hierarchical regression analyses were performed. Following Analysis 1, the negatively evaluated bias (SB) of SRT was set as the dependent variable. The social anxiety measures, including the SADS, LSAS, SIAS and SPS were entered in the first block, and all paranoia measures including the PS, GTPS and PDI were entered in the second block. The results showed that only model 1 (entering: SA measures) was significant, and that the model was no longer significant after adding paranoia measures. Model 1 indicated that 7.58% of the variance in the dependent variable could be accounted for by social anxiety measures (Adjusted $R^2 = 0.0758$, $F(4, 76) = 2.64$, $p < .05$). Thus, trait social anxiety significantly explained the variance in the SRT reflected negatively evaluated bias. The SPS explained most of the variance in the dependent variable. Therefore, only social anxiety measures significantly explained the variance in the negatively evaluated bias of the SRT, and paranoia measures did not contribute to variance in the dependent variable. In sum, the results suggested that only participants with higher scores on social anxiety measures showed a preference for rating socially anxious interpretations when completing the SRT. The same interpretation bias was not found in participants with higher scores on paranoia measures.

Following Analysis 2, PA trait scores were entered in the first block and SA trait scores in the second block. The results showed that model 3 (entering: PA trait scores) only reached marginal significance, and model 4 (entering: SA trait scores and PA trait scores) was not significant. Therefore, only SA trait scores significantly explained the variance in the SRT negatively evaluated bias. In sum, participants with higher scores on social anxiety measures rated sentences reflecting socially anxious meaning highly.

Table 2.5 Statistical predictors of SRT: negatively evaluated bias

					Independent measures	B	Beta	t	Sig.	
	R	R ²	Adjusted R ²							
Analysis 1	Model 1	0.3492	0.122	0.0758*	ST	SADS	0.01	0.20	1.25	0.22
						LSAS	-0.001	-0.05	-0.23	0.82
						SIAS	-0.01	-0.27	-1.30	0.20
						SPS	0.02	0.44	2.40	0.02
	Model 2	0.3806	0.1448	0.0628	ST	SADS	0.02	0.21	1.32	0.19
						LSAS	-0.001	-0.05	-0.26	0.80
						SIAS	-0.01	-0.29	-1.34	0.18
						SPS	0.01	0.32	1.59	0.12
					PT	PS	-0.002	-0.07	-0.28	0.78
						GTPS	0.003	0.14	0.56	0.58
						PDI	0.001	0.12	0.57	0.57
						The model was only significant when ST alone were entered				
Analysis 2	Model 3	0.3048	0.0929	0.0576	PT	PS	0.001	0.01	0.05	0.96
						GTPS	0.07	0.1	0.001	0.001
						PDI	0.001	0.22	1.14	0.26
	Model 4	0.3806	0.1448	0.0628	PT	PS	0.0001	-0.07	-0.28	0.78
						GTPS	0.16	0.22	0.0001	0.01
						PDI	0.0001	0.12	0.57	0.57
					ST	SADS	0.02	0.21	1.32	0.19
						LSAS	0.0001	-0.05	-0.26	0.80
						SIAS	-0.01	-0.29	-1.34	0.18
						SPS	0.01	0.32	1.59	0.12
None of the two models were significant										
SB was only explained by ST at 7.58%										

Note: The dependent variable= SRT negatively evaluated bias. *p <0.05, **p <0.01. Note, N= 82. *p <0.05, **p <0.01. Negatively evaluated bias= scores in social anxiety related meaning; persecutory bias= scores in paranoia related meaning; LSAS: Liebowitz Social Anxiety Scale (Liebowitz, 1987); SIAS: Social Interaction Anxiety Scale (Mattick & Clarke, 1998); SPS: Social Phobia Scale (Mattick & Clarke, 1998); GTPS: Green et al. Paranoid Thought Scales (Green et al., 2008); PS: Self-report Paranoia Scale (Fenigstein & Vanable, 1992); PDI: Peters Delusions Inventory (PDI; Peters et al., 1999). SRT: Similarity Ratings Task (SRT, Based on Eysenck et al. 1991). ST = social anxiety trait; PT paranoia trait; SB = negatively evaluated interpretation bias; PB= persecutory interpretation bias scores

Results indicating the correlational relationship between paranoia content-specific interpretation bias and its matched traits are presented in Table 2.6. Following Analysis 1, the persecutory bias of SRT was set as the dependent variable. Paranoia measures were entered in the first block, and social anxiety measures in the second block. The results indicated that both model 1 (entering: PA measures) and model 2 (entering: PA measures and SA measures) were significant. Model 1 revealed that 14.24% of the variance in the dependent variable could be accounted for by paranoia measures (Adjusted $R^2 = 0.1424$, $F(3, 72) = 5.15$, $p = .003$). Thus, trait paranoia significantly explained the variance in the SRT reflected persecutory bias. No significant measure emerged at this stage. After adding the social anxiety measures into the model, the change in Adjusted R^2 suggests that social anxiety measures decreased 0.72% of variance in the outcome variable (Adjusted $R^2 = 0.1352$, $F(7, 68) = 2.68$, $p = .02$). Therefore, although both social anxiety and paranoia measures explain a significant amount of the variance in the persecutory bias of SRT, significance was reduced after adding social anxiety measures. In sum, the results suggest that participants with higher scores on social anxiety measures and those with higher scores on paranoia measures rate paranoia interpretations more highly when completing the SRT.

Following Analysis 2, SA trait scores were entered in the first block and PA trait scores in the second block. Model 3 (entering: SA trait scores) and model 4 (entering: SA trait scores and PA trait scores) are both significant. When PA trait scores are added to the model, the change in Adjusted R^2 suggests that PA trait scores account for an additional 2.41% of variance in the outcome variable (Adjusted $R^2 = 0.1352$, $F(2, 81) = 2.68$, $p < .0001$). The Δ Adjusted R^2 between Models 3 and 4 is greater than the Δ Adjusted R^2 between Models 1 and 2 at Δ Adjusted R^2 change = 0.0313. Therefore, although both SA trait scores and PA trait scores explain a significant amount of variance in the SRT negatively evaluated bias, PA trait scores contribute more than SA trait scores to variance in the dependent variable. In sum, participants with higher scores on social anxiety measures and those with higher scores on paranoia measures rated sentences reflecting paranoid meaning highly, while participants with higher scores on paranoia measures had higher ratings.

Table 2.6 Statistical predictors of SRT-persecutory bias

Table 2.6 Statistical predictors of CRT persecutory bias					Independent measures	B	Beta	t	Sig.	
		R	R ²	Adjusted R ²						
Analysis 1	Model 1	0.4204	0.1768	0.1424*	PT	PS	0.011	0.315	1.476	0.144
						LSAS	-0.001	-0.061	-0.254	0.800
						PDI	0.002	0.189	1.025	0.309
	Model 2	0.4647	0.2159	0.1352*	PT	PS	0.007	0.20	0.81	0.42
						LSAS	0.001	0.03	0.13	0.90
						PDI	0.002	0.16	0.78	0.44
					ST	SADS	0.02	0.27	1.72	0.09
						LSAS	0.003	0.13	0.62	0.54
						SIAS	-0.007	-0.19	-0.91	0.36
						SPS	-0.002	-0.04	-0.22	0.83
Adding ST decreases the variance explained ($\Delta R^2= 0.0072$)=0.72%										
Analysis 2	Model 3	0.3981	0.1585	0.1111**	ST	SADS	0.02	0.28	1.82	0.07
						LSAS	0.07	0.19	0.94	0.35
						SIAS	-0.01	-0.14	-0.70	0.48
						SPS	0.01	0.13	0.72	0.47
	Model 4	0.4647	0.2159	0.1352**	ST	SADS	0.02	0.27	1.72	0.09
						LSAS	0.003	0.13	0.62	0.54
						SIAS	-0.007	-0.19	-0.91	0.36
						SPS	-0.002	-0.04	-0.22	0.83
					PT	PS	0.007	0.20	0.81	0.42
						GTPS	0.001	0.03	0.13	0.90
PDI						0.002	0.16	0.78	0.44	
Adding PT increases the variance explained ($\Delta R^2= 0.0241$)=2.41%										
Analysis summary: when controlling for the alternative traits more variance in PB was explained by PT (2.41%) than ST (-0.72%)										

Note: The dependent variable= SRT persecutory bias. *p <0.05, **p <0.01. Note, N= 82. *p <0.05, **p <0.01. Negatively evaluated bias= scores in social anxiety related meaning; persecutory bias= scores in paranoia related meaning; LSAS: Liebowitz Social Anxiety Scale (Liebowitz, 1987); SIAS: Social Interaction Anxiety Scale (Mattick & Clarke, 1998); SPS: Social Phobia Scale (Mattick & Clarke, 1998); GTPS: Green et al. Paranoid Thought Scales (Green et al., 2008); PS: Self-report Paranoia Scale (Fenigstein & Vanable, 1992); PDI: Peters Delusions Inventory (PDI; Peters et al., 1999). SRT: Similarity Ratings Task (SRT, Based on Eysenck et al. 1991). ST = social anxiety trait; PT paranoia trait; SB = negatively evaluated interpretation bias; PB= persecutory interpretation bias scores

2.3.3.2 Scrambled Sentences Task (SST)

Bivariate correlations

Bivariate correlations between SST scores and individual trait measures were examined. Correlation coefficients are presented in Table 2.7. Of the social anxiety trait measures, FNE scores did not correlate significantly with SST scores. FNE was thus excluded from the next step of analysis. All other social anxiety trait measures correlated significantly with both SST task scores. The SPS correlated most strongly with the negatively evaluated bias of SST. The SIAS correlated most strongly with the persecutory bias of SST. Of the paranoia trait measures: all scores correlated significantly with both the SST score in negatively evaluated bias and in the persecutory bias. The GTPS and PDI score correlated most strongly with the negatively evaluated bias of SST. The PDI score correlated most strongly with the persecutory bias of SST.

Table 2.7 Correlation coefficients of the SST scores and trait measures

		SST (%)			
		Negatively evaluated bias		Persecutory bias	
		r	p	r	p
Social anxiety measures	FNE	-0.05	0.65	-0.11	0.34
	SADS	.41**	<.001	.47**	<.001
	LSAS	.41**	<.001	.47**	<.001
	SIAS	.41**	<.001	.53**	<.001
	SPS	.45**	<.001	.48**	<.001
Paranoia measures	PS	.39**	<.001	.43**	<.001
	GTPS	.40**	<.001	.47**	<.001
	PDI	.40**	<.001	.49**	<.001

Note: N= 80. *p <0.05, **p <0.01. Negatively evaluated bias= scores in social anxiety related meaning; persecutory bias= scores in paranoia related meaning; LSAS: Liebowitz Social Anxiety Scale (Liebowitz, 1987); SIAS: Social Interaction Anxiety Scale (Mattick & Clarke, 1998); SPS: Social Phobia Scale (Mattick & Clarke, 1998); GTPS: Green et al. Paranoid Thought Scales (Green et al., 2008); PS: Self-report Paranoia Scale (Fenigstein & Vanable, 1992); PDI: Peters Delusions Inventory (PDI; Peters et al., 1999). SST: Scrambled Sentences Task (SST; Based on Wenzlaff & Bates, 1998)

Hierarchical regression analyses were performed to assess the correlational relationship between social anxiety content-specific interpretation bias and matched trait scores.

Following Analysis 1, the negatively evaluated bias of SST was set as the dependent variable. Social anxiety measures, including the SADS, LSAS, SIAS and SPS were entered in the first block and all paranoia measures, including the PS, GTPS and PDI were entered in the second block. Models 1 (entering: SA measures) and 2 (entering: SA measures and

PA measures) were significant. Model 1 indicated that 20.95% of variance in the dependent variable could be accounted for by the social anxiety measures (Adjusted $R^2 = 0.2095$, $F(4, 78) = 6.43$, $p < .0001$). Thus, trait social anxiety explained variance in the SST reflected negatively evaluated bias. In model 1, the t -test for the *SPS* reached only marginal significance, and appeared to explain most of the variance in the dependent variable. When paranoia measures were added to the model, the change in Adjusted R^2 suggested that the paranoia measures accounted for less than 0.04% of variance in the outcome variable (Adjusted $R^2 = 0.2091$, $F(7, 75) = 4.10$, $p < .001$). As shown in Table 2.8, the *SADS* reached only marginal significance in the final model. Therefore, although social anxiety measures explained a significant amount of the variance in the negatively evaluated bias of SST, the paranoia measures also contributed to variance in the dependent variable. In sum, the results suggest that both participants with higher scores on social anxiety measures and those with higher scores on paranoia measures demonstrated a preference for socially anxious words when completing the SST, reflecting a socially anxious interpretation bias.

Following Analysis 2, PA trait scores were entered in the first block and SA trait scores in the second block. Models 3 (entering: PA trait scores) and 4 (entering: SA trait scores and PA trait scores) were both significant. When SA trait scores were added to the model, the change in Adjusted R^2 suggests that SA trait scores account for an additional 4.71% of variance in the outcome variable (Adjusted $R^2 = 0.2076$, $F(2, 81) = 6.23$, $p < .001$). The Δ Adjusted R^2 between Models 3 and 4 is greater than the Δ Adjusted R^2 between Models 1 and 2 at Δ Adjusted R^2 change = 0.0427. Therefore, although both SA trait scores and PA trait scores explain a significant amount of the variance in the SST negatively evaluated bias, the SA trait scores contribute more than do PA trait scores to variance in the dependent variable. In sum, both participants with higher scores on social anxiety measures and those with higher scores on paranoia measures chose unscramble sentences reflecting socially anxious meaning. Participants with higher scores on social anxiety measures unscrambled more

Table 2.8 Statistical predictors of SST: negatively evaluated bias (SB)

Table 2: Statistical predictors of SB negatively evaluated bias (SB)										
		R	R ²	Adjusted R ²	Independent measures		B	Beta	t	Sig.
Analysis 1	Model 1	0.498	0.2481	0.2095**	ST	SADS	0.61	0.23	1.62	0.11
						LSAS	0.03	0.04	0.22	0.83
						SIAS	0.01	0.01	0.03	0.98
						SPS	0.45	0.3	1.81	0.07
	Model 2	0.526	0.2767	0.2091**	ST	SADS	0.68	0.26	1.78	0.08
						LSAS	0.04	0.05	0.24	0.81
						SIAS	-0.02	-0.01	-0.06	0.96
						SPS	0.28	0.18	1	0.32
					PT	PS	-0.15	-0.12	-0.57	0.57
						GTPS	0.16	0.22	1.03	0.31
						PDI	0.03	0.08	0.42	0.68
						Adding PT reduces variance explained ($\Delta R^2 = -0.0004$)=-0.04%				
Analysis 2	Model 3	0.4373	0.1912	0.1605**	PT	PS	0.21	0.16	0.91	0.37
						GTPS	0.15	0.1	0.48	0.64
						PDI	0.08	0.21	1.16	0.25
	Model 4	0.5246	0.2752	0.2076**	PT	PS	-0.11	-0.08	-0.4	0.69
						GTPS	0.16	0.22	1.04	0.30
						PDI	0.04	0.11	0.61	0.55
					ST	SADS	-0.35	-0.09	-0.92	0.36
						LSAS	0.68	0.26	1.79	0.08
						SIAS	0.08	0.11	0.62	0.54
						SPS	0.06	0.05	0.23	0.82
Adding ST increases variance explained ($\Delta R^2 = 0.0471$)=4.71%										
Analysis summary: when controlling for the alternative traits more variance in SB was explained by ST (4.71%) than PT (-0.04%)										

Note: The dependent variable= SST negatively evaluated bias. *p <0.05, **p <0.01. Note, N= 82. *p <0.05, **p <0.01. Negatively evaluated bias= scores in social anxiety related meaning; persecutory bias= scores in paranoia related meaning; LSAS: Liebowitz Social Anxiety Scale (Liebowitz, 1987); SIAS: Social Interaction Anxiety Scale (Mattick & Clarke, 1998); SPS: Social Phobia Scale (Mattick & Clarke, 1998); GTPS: Green et al. Paranoid Thought Scales (Green et al., 2008); PS: Self-report Paranoia Scale (Fenigstein & Venable, 1992); PDI: Peters Delusions Inventory (PDI; Peters et al., 1999). SRT: Similarity Ratings Task (SRT, Based on Eysenck et al. 1991). ST = social anxiety trait; PT paranoia trait; SB = negatively evaluated interpretation bias; PB= persecutory interpretation bias scores

The correlational relationship between paranoia content-specific interpretation bias and its matched traits is presented in Table 2.9. Following Analysis 1, the persecutory bias of SST was set as the dependent variable. Paranoia measures were entered in the first block and social anxiety measures in the second block. Models 1 (entering: paranoia measures) and 2 (entering: paranoia measures and social anxiety measures) were significant. According to model 1, 23.61% of variance in the dependent variable is accounted for by the paranoia measures (Adjusted $R^2 = 0.2361$, $F(3, 79) = 9.45$, $p < .0001$). Paranoia measures thus significantly explains the variance in the SST reflected persecutory bias. In model 1, the t -test for the *PDI* reached only marginal significance, and appeared to explain most of the variance in the dependent variable. After adding the social anxiety measures into the model, the change in R^2 suggested that social anxiety measures accounted for an additional 10.14% of variance in the outcome variable (Adjusted $R^2 = 0.3375$, $F(7, 75) = 6.97$, $p < .0001$). As shown in Table 2.9, the *SADS* reached marginal significance in the final model. Therefore, although the paranoia measures explaining a significant amount of the variance in the persecutory bias of SST, the social anxiety measures also contributed to variance in the dependent variable. In sum, the results suggest that both participants with higher scores on social anxiety measures and those with higher scores on paranoia measures indicate a preference for paranoia words when completing the SST, reflecting a paranoid interpretation bias.

Following Analysis 2, SA trait scores were entered in the first block and PA trait scores in the second block. Models 3 (entering: SA trait scores) and 4 (entering: SA trait scores and PA trait scores) were both significant. When PA trait scores were added to the model, the change in Adjusted R^2 suggested that PA trait scores account for an additional 4.45% of variance in the outcome variable (Adjusted $R^2 = 0.2930$, $F(2, 81) = 9.49$, $p < .0001$). The Δ Adjusted R^2 between Models 3 and 4 is less than the Δ Adjusted R^2 between Models 1 and 2 at Δ Adjusted R^2 change = -0.0569. Although both SA trait scores and PA trait scores explain a significant amount of variance in the SST negatively evaluated bias, SA trait scores contributed more than PA trait scores to the variance in the dependent variable. In sum, both participants with higher scores on social anxiety measures and those with showing higher

scores on paranoia measures chose unscramble sentences reflecting paranoia meaning, while participants with higher scores on social anxiety measures unscrambled more.

Table 2.9 Statistical predictors of SST: persecutory bias

					Independent measures		B	Beta	t	Sig.
		R	R ²	Adjusted R ²						
Analysis 1	Model 1	0.5139	0.2641	0.2361**	PT	PS	0.14	0.10	0.57	0.57
						LSAS	0.03	0.14	0.11	0.16
						PDI	0.13	0.31	1.82	0.07
	Model 2	0.6278	0.3941	0.3375**	PT	PS	-0.36	-0.26	-1.38	0.17
						LSAS	0.04	0.28	0.22	0.15
						PDI	0.09	0.21	1.21	0.23
					ST	SADS	0.66	0.23	1.74	0.09
						LSAS	0.03	0.04	0.22	0.83
						SIAS	0.35	0.23	1.31	0.20
						SPS	0.06	0.04	0.21	0.83
Adding ST increases variance explained ($\Delta R^2= 0.1014$)=10.14%										
Analysis 2	Model 3	0.5723	0.3275	0.2930**	ST	SADS	0.54	0.19	1.38	0.17
						LSAS	0.03	0.04	0.02	0.15
						SIAS	0.35	0.23	0.36	0.28
						SPS	0.34	0.21	1.32	0.19
	Model 4	0.6278	0.3941	0.3375**	ST	SADS	0.66	0.23	1.74	0.09
						LSAS	0.16	0.22	0.03	0.15
						SIAS	0.35	0.23	1.31	0.20
						SPS	0.06	0.04	0.21	0.83
					PT	PS	-0.36	-0.26	-1.38	0.17
						GTPS	0.22	0.28	1.44	0.15
						PDI	0.09	0.21	1.21	0.23
						Adding PT increases variance explained ($\Delta R^2= 0.0445$)=4.45%				
Analysis summary: when controlling for the alternative traits less variance in PB was explained by PT (4.45%) than ST (10.14%)										

Note: The dependent variable= SST persecutory bias. *p <0.05, **p <0.01. Note, N= 82. *p <0.05, **p <0.01. Negatively evaluated bias= scores in social anxiety related meaning; persecutory bias= scores in paranoia related meaning; LSAS: Liebowitz Social Anxiety Scale (Liebowitz, 1987); SIAS: Social Interaction Anxiety Scale (Mattick & Clarke, 1998); SPS: Social Phobia Scale (Mattick & Clarke, 1998); GTPS: Green et al. Paranoid Thought Scales (Green et al., 2008); PS: Self-report Paranoia Scale (Fenigstein & Vanable, 1992); PDI: Peters Delusions Inventory (PDI; Peters et al., 1999). SRT: Similarity Ratings Task (SRT, Based on Eysenck et al. 1991)

2.3.3.3 Word-Sentence Association Paradigm (WSAP)

The bivariate correlations of WSAP and individual trait measures were assessed. Table 2.10 shows the correlation coefficients. Of the social anxiety trait measures, only the SADS and SIAS were significantly correlated with the negatively evaluated bias of the WSAP. The SADS was significantly correlated with the persecutory bias of the WSAP. Of the paranoia trait measures, the PS and GTPS correlated significantly with both WSAP scores in the negatively evaluated bias and the persecutory bias. The PDI was not significantly correlated with any of the WSAP scores. FNE, LSAS, SPS and the PDI were therefore excluded from the next step of analysis.

Table 2.10 Correlation coefficients of WSAP scores and trait measures

		WSAP			
		Negatively evaluated bias		Persecutory bias	
		r	p	r	p
Social anxiety measures	FNE	0.14	0.24	0.11	0.34
	SADS	0.29**	0.009	0.36**	0.001
	LSAS	0.19	0.11	0.14	0.24
	SIAS	0.36**	0.001	0.22	0.06
	SPS	0.21	0.07	0.18	0.12
Paranoia measures	PS	0.39**	0.02	0.26*	0.02
	GTPS	0.24*	0.03	0.27*	0.02
	PDI	0.11	0.32	0.12	0.29

*p < 0.05, **p < 0.01. N= 80. Negatively evaluated bias= scores in social anxiety related meaning; persecutory bias= scores in paranoia related meaning; LSAS: Liebowitz Social Anxiety Scale (Liebowitz, 1987); SIAS: Social Interaction Anxiety Scale (Mattick & Clarke, 1998); SPS: Social Phobia Scale (Mattick & Clarke, 1998); GTPS: Green et al. Paranoid Thought Scales (Green et al., 2008); PS: Self-report Paranoia Scale (Fenigstein & Venable, 1992); PDI: Peters Delusions Inventory (PDI; Peters et al., 1999). WSAP: The word-sentence association paradigm (WSAP, Based on Beard & Amir, 2010)

To assess the correlational relationship between social anxiety content-specific interpretation bias and its matched traits, hierarchical regression analyses were performed. The negatively evaluated bias of WSAP was set as the dependent variable. Social anxiety measures, including SADS and SIAS, were entered in the first block and paranoia measures, including PS and GTPS were entered in the second block. Models 1 (entering: SA measures) and 2 (entering: SA measures and PA measures) were significant. Model 1 indicated that 11.34% of variance in the dependent variable is accounted for by social anxiety measures (Adjusted $R^2 = 0.1134$, $F(2, 72) = 5.73$, $p = .005$). Trait social anxiety thus significantly explains the

variance in the WSAP reflected negatively evaluated bias. In model 1, the *t*-test for the *SIAS* significantly explained the variance in the dependent variable. Adjusted R^2 decreased by 1.79% when paranoia measures were added to the model (Adjusted $R^2 = 0.0955$, $F(4,70) = 2.95$, $p = .03$). As shown in Table 2.11, none of the measures were significant. Therefore, although both social anxiety and paranoia measures significantly explain the variance in the WSAP negatively evaluated bias, social anxiety measures contributed most to the variance in the dependent variable. In sum, both participants with higher scores on social anxiety measures and those with higher scores on paranoia measures were quicker to relate to socially anxious words on the WSAP.

Following Analysis 2, PA trait scores were entered in the first block and SA trait scores in the second block. Only model 4 (entering: SA trait scores and PA trait scores) was significant. When SA trait scores are added to the model, the change in Adjusted R^2 suggests that SA trait scores account for an additional 5.20% of variance in the outcome variable (Adjusted $R^2 = 0.0960$, $F(2, 81) = 2.95$, $p < .05$). The Δ Adjusted R^2 between Models 3 and 4 is greater than the Δ Adjusted R^2 between Models 1 and 2 at Δ Adjusted R^2 change = 0.0699. Therefore, only SA trait scores significantly explain the variance in the WSAP negatively evaluated bias. In sum, the results suggest that only participants with higher scores on social anxiety measures had quicker reaction times on the WSAP when endorsing words with socially anxious meaning, while participants with higher scores on paranoia measures did not.

Table 2.11 Statistical predictors of WSAP: negatively evaluated bias

		R	R ²	Adjusted R ²	Independent measures					
						B	Beta	t	Sig.	
Analysis 1	Model 1	0.3706	0.1374	0.1134*						
	Model 2	0.3800	0.1444	0.0955*	ST	SADS	1.35	0.07	0.48	0.64
					ST	SIAS	0.03	0.04	3.08	1.53
					ST	SADS	1.72	0.09	0.58	0.56
					ST	SIAS	0.04	0.05	2.83	1.75
Analysis 2	Model 3	0.2650	0.0700	0.0440	PT	PS	-1.00	-0.11	-0.43	0.67
					PT	GTPS	0.81	0.16	0.70	0.49
	Model 4	0.3800	0.1440	0.0960*	PT	PS	2.42	0.27	1.17	0.25
					PT	GTPS	-0.77	-0.28	-1.44	0.15
					PT	PS	-1.00	-0.11	-0.43	0.67
					ST	SIAS	2.83	0.29	1.62	0.11

Adding PT reduces the variance explained ($\Delta R^2 = -0.0179$) = -1.79

Adding ST increases the variance explained ($\Delta R^2 = 0.0520$) = 5.20%

Analysis summary: when controlling for the alternative traits more variance in SB was explained by ST (5.20%) than PT (-1.79%)

Note: The dependent variable= WSAP negatively evaluated bias. *p <0.05, **p <0.01. N= 80. Negatively evaluated bias= scores in social anxiety related meaning; persecutory bias= scores in paranoia related meaning; LSAS: Liebowitz Social Anxiety Scale (Liebowitz, 1987); SIAS: Social Interaction Anxiety Scale (Mattick & Clarke, 1998); SPS: Social Phobia Scale (Mattick & Clarke, 1998); GTPS: Green et al. Paranoid Thought Scales (Green et al., 2008); PS: Self-report Paranoia Scale (Fenigstein & Venable, 1992); PDI: Peters Delusions Inventory (PDI; Peters et al., 1999). WSAP: The word-sentence association paradigm (WSAP, Based on Beard & Amir, 2010). ST = social anxiety trait; PT paranoia trait; SB = negatively evaluated interpretation bias; PB= persecutory interpretation bias scores

The correlational relationship between paranoia content-specific interpretation bias and its matched traits are presented in Table 2.12. The WSAP persecutory bias was set as the dependent variable. Paranoia measures were entered in the first block and social anxiety measures in the second block. Models 1 (entering: PA measures) and 2 (entering: PA measures and SA measures) were significant. According to Model 1, 5.86% of variance in the dependent variable could be accounted for by paranoia measures (Adjusted $R^2 = 0.29$, $F(3, 72) = 3.30$, $p = .04$). Trait paranoia thus significantly explains the variance in the WSAP reflected persecutory bias. After adding the social anxiety measures into the model, the change in Adjusted R^2 suggests that social anxiety measures account for an additional 8.27% of variance in the outcome variable (Adjusted $R^2 = 0.1413$, $F(4, 70) = 4.04$, $p = .005$). As seen in Table 2.12, the SADS explains most of the variance in the WSAP target variable, reflecting a paranoid interpretation bias. Therefore, although paranoia measures explain a significant amount of the variance in the persecutory bias of the WSAP, social anxiety measures also contributed significantly to the model. In sum, both participants with higher scores on social anxiety measures and those with higher scores on paranoia measures had quicker WSAP reaction times when endorsing words with paranoid meaning.

Following Analysis 2, SA trait scores were entered in the first block and PA trait scores in the second block. Models 3 (entering: SA trait scores) and 4 (entering: SA trait scores and PA trait scores) were both significant. When PA trait scores were added to the model, the change in Adjusted R^2 suggested that SA trait scores accounted for an additional 2.48% of the variance in the outcome variable (Adjusted $R^2 = 0.1413$, $F(2, 81) = 4.04$, $p < .0001$). The Δ Adjusted R^2 between Models 3 and 4 is greater than the Δ Adjusted R^2 between Models 1 and 2 at Δ Adjusted R^2 change = -0.0579. Therefore, although both SA trait scores and PA trait scores explain a significant amount of variance in the WSAP negatively evaluated bias, SA trait scores contribute more than do PA trait scores to variance in the dependent variable. In sum, both participants with higher scores on social anxiety measures and those with higher scores on paranoia measures responded more quickly to WSAP items when endorsing words with paranoid meaning, while socially anxious participants were even faster.

Table 2.12 Statistical predictors of WSAP: persecutory bias

		R	R ²	Adjusted R ²						
					Independent measures	B	Beta	t	Sig.	
Analysis 1	Model 1	0.29	0.084	0.0586*	PT	PS	1.16	0.14	0.60	0.55
						GTPS	0.75	0.16	0.70	0.49
	Model 2	0.433	0.188	0.1413*	PT	PS	-0.80	-0.10	-0.38	0.71
						GTPS	0.04	GTPS	1.48	1.05
					ST	SADS	7.86	0.46	2.93	0.01*
						SIAS	-1.90	-0.21	-1.19	0.24
Adding ST increases the variance explained ($\Delta R^2= 0.0827$)=8.27%										
Analysis 2	Model 3	0.4178	0.1086	0.1165**	ST	SADS	7.36	0.43	2.77	0.01*
						SIAS	-0.80	-0.09	-0.56	0.58
	Model 4	0.433	0.188	0.1413**	ST	SADS	7.86	0.46	2.93	0.01*
						SIAS	0.16	0.21	-1.90	1.60
					PT	PS	-0.80	-0.10	-0.38	0.71
						GTPS	1.48	0.32	1.41	0.16
Adding PT increases the variance explained ($\Delta R^2= 0.0248$)=2.48%										
Analysis summary: when controlling for the alternative traits less variance in PB was explained by PT (2.48%) than ST (8.27%)										

Note: The dependent variable= WSAP persecutory bias. *p <0.05, **p <0.01. *p <0.05, **p <0.01. N= 80. Negatively evaluated bias= scores in social anxiety related meaning; persecutory bias= scores in paranoia related meaning; LSAS: Liebowitz Social Anxiety Scale (Liebowitz, 1987); SIAS: Social Interaction Anxiety Scale (Mattick & Clarke, 1998); SPS: Social Phobia Scale (Mattick & Clarke, 1998); GTPS: Green et al. Paranoid Thought Scales (Green et al., 2008); PS: Self-report Paranoia Scale (Fenigstein & Vanable, 1992); PDI: Peters Delusions Inventory (PDI; Peters et al., 1999). WSAP: The word-sentence association paradigm (WSAP, Based on Beard & Amir, 2010). ST = social anxiety trait; PT paranoia trait; SB = negatively evaluated interpretation bias; PB= persecutory interpretation bias scores

2.3.4 Hypothesis-Driven Analyses

Composite scores were calculated based on raw data, to test our hypothesis directly. Composite scores were used to achieve greater clarity. The results of composite score analysis should be consistent with that using individual scores. In order to test our hypothesis directly, models explaining each emotional trait (SA/PA trait) were tested using two analyses. In analysis one, the content-matched interpretation bias was entered as an independent variable first; the conversed (content-incongruent) interpretation bias, second. For example, in explaining the SA trait, the SB was entered in the first block and the PB in the second block. In analysis two, the conversed interpretation bias was entered as an independent variable first; the content-matched interpretation bias, second. Following the example above, PB was entered in the first block, and SB in the second block. Analysis two allowed a strength test of content-specific bias in explaining its matched trait composite, when controlling for the converse. This generated two Δ Adjusted R^2 . The change in Δ Adjusted R^2 between the two analyses indicated that the additional variance in the trait composite is accounted for by one bias composite, over and above the other. Which Adjusted R^2 value is greater indicates which direction of the interpretation bias explains the most variance in the outcome emotional trait.

Composites scores were created for emotional traits and interpretation bias. Four composite scores represented the social anxiety (SA) trait, paranoia (PA) trait, social anxiety related (SAR) bias and paranoia related (PA) bias. Composites were generated by standardising ($M = 0$, $SD = 1$) participant scores on each measure and task, then averaging these. The composite score representing the SA trait was calculated by averaging the Z scores of the SADS, LSAS, SIAS and SPS. The FNE was excluded, as it was not significantly correlated with any of the tasks in preliminary analyses (see Section 2.4.3.1, 2.4.3.2 and 2.4.3.3). The composite score representing the PA trait was calculated by averaging the PS, GTPS and PDI. The social anxiety related bias scores from the SST, SRT and WSAP were averaged to generate a composite score for social anxiety related interpretation bias. The paranoia related bias scores from the SST, SRT and WSAP were averaged to generate a composite score for paranoia related interpretation bias (see Table 2.1).

2.3.4.1 Bivariate Correlations between Composite Scores

Correlations among independent bias composites and between bias composites and dependent measures, are presented in Table 2.13. The correlation coefficient of the independent variables was < 0.8 . It was therefore appropriate to assess SB and PB composites as distinct constructs, which will both be used as independent variables to test interpretation bias.

Table 2.13 Correlation coefficients of the composite scores

	ST		PT		SB		PB	
	r	p	r	p	r	p	r	p
ST	1							
PT	.69**	<.001	1					
SB	.55**	<.001	.51**	<.001	1			
PB	.51**	<.001	.51**	<.001	.68**	<.001	1	

Note: PT=paranoia trait; ST=social anxiety trait; PB=paranoia bias; SB=social anxiety bias; * $p < 0.05$, ** $p < 0.01$. N= 80.

2.3.4.2 Hierarchical Regression

To test the hypotheses, hierarchical regression analyses were performed in order to assess the association of interpretation bias in predicting its content matched emotional trait. To predict SA trait and following Analysis 1, the composite of interpretation bias reflecting social anxiety meaning (SB) was entered in the first block and the composite of interpretation bias reflecting paranoia meaning (PB) in the second block. Models 1 (entering: SB) and 2 (entering: SB and PB) were both significant. Model 1 indicated that 29.60% of the variance in the dependent variable could be accounted for by SB (Adjusted $R^2 = 0.2960$, $F(1, 82) = 35.82$, $p < .0001$). SB composite thus significantly explained the variance in the SA trait composite. When the PB composite was added to the model, the change in Adjusted R^2 suggested that the PB accounted for an additional 2.60% of the variance in the outcome variable (Adjusted $R^2 = 0.32.20$, $F(2, 81) = 20.73$, $p < .001$). As shown in Table 2.14, both SB composite and PB composite were significant predictors. Following Analysis 2, PB was entered in the first block and SB in the second block. Models 3 (entering: PB) and 4 (entering: PB and SB) were both significant. Model 3 indicated that 25.36% of the variance in the dependent variable could be accounted for by PB (Adjusted $R^2 = 0.2536$, $F(1, 82) = 35.82$, $p < .0001$). When SB composite was added to the model, the change in Adjusted R^2

suggests that SB accounts for an additional 6.87% of variance in the outcome variable (Adjusted $R^2 = 0.3223$, $F(2, 81) = 20.73$, $p < .001$). Again, both SB and PB composite were significant predictors. The Δ Adjusted R^2 between Models 3 and 4 is greater than the Δ Adjusted R^2 between Models 1 and 2 at Δ Adjusted $R^2 = 0.0427$. Therefore, although both SB and PB composite explain a significant amount of variance in the SA trait composite, the SB composite contributes more to the variance in the dependent variable than does PB. In sum, both participants exhibiting interpretation bias in the direction of SA and those exhibiting interpretation bias in the direction of PA were highly vulnerable to social anxiety, while participants exhibiting interpretation bias in the direction of SA were more vulnerable to social anxiety.

Table 2.14 Statistical predictors of the ST composite

		R	R ²	Adjusted R ²	Independent measures	B	Beta	t	Sig.
Analysis 1	Model 1	0.55	0.30	0.2960**	SB	0.74	0.55	5.99	<0.0001*
	Model 2	0.58	0.34	0.3220**	SB	0.51	0.38	3.05	<0.0001*
					PB	0.29	0.26	2.06	0.04*
Adding PB increases the variance explained ($\Delta R^2 = 0.0260$)=2.60%									
Analysis 2	Model 3	0.51	0.26	0.2536**	PB	0.58	0.51	5.40	<0.0001*
	Model 4	0.58	0.34	0.3223**	PB	0.29	0.25	2.06	0.04*
					SB	0.51	0.38	3.05	<0.0001*
Adding SB increases the variance explained ($\Delta R^2 = 0.0687$)=6.87%									
Analysis summary: when controlling for the alternative bias more variance in ST was explained by SB (6.87%) than PB (2.60%)									

Note: The dependent variable= the SA trait (ST) composite. *p <0.05, **p <0.01. ST= the composite of social anxiety trait measures: the SADS, LSAS, SIAS, and the SPS; PT= the composite of paranoia trait measures: the PS, GTPS, and the PDI; SB= the composite of negatively evaluated interpretation bias scores of the SST, SRT, and the WSAP; PB= the composite of persecutory interpretation bias scores of the SST, SRT, and the WSAP.

To predict PT and following Analysis 1, the composite of interpretation bias reflecting paranoia meaning (PB) was entered in the first block and the composite of interpretation bias reflecting social anxiety meaning (SB) in the second block. Models 1 (entering: PB) and 2 (entering: PB and SB) were both significant. Model 1 indicated that 25.49% of variance in the dependent variable could be accounted for by PB (Adjusted $R^2 = 0.2549$, $F(1, 82) = 29.39$, $p < .0001$). PB composite thus significantly explains the variance in the PA trait composite. As shown in Table 2.15, when SB composite was added to the model, the change in Adjusted R^2 suggested that SB accounts for an additional 3.66% of variance in the outcome variable (Adjusted $R^2 = 0.2915$, $F(2, 81) = 18.07$, $p < .001$). As shown in Table 2.15, both PA and SB composites are significant predictors. Following Analysis 2, SB was entered in the first block and PB in the second block. The results showed that models 3 (entering: SB) and 4 (entering: SB and PB) were both significant. Model 3 indicated that 24.62% of variance in the dependent variable could be accounted for by SB (Adjusted $R^2 = 0.2462$, $F(1, 82) = 35.82$, $p < .0001$). When PB composite was added to the model, the change in Adjusted R^2 suggested that PB accounts for an additional 4.53% of the variance in the outcome variable (Adjusted $R^2 = 0.2915$, $F(2, 81) = 20.73$, $p < .001$). Again, both SB composite and PB composite were significant predictors. The Δ Adjusted R^2 from Models 3 to 4 is greater than the Δ Adjusted R^2 from Models 1 to 2, at Δ Adjusted $R^2 = 0.0087$. Therefore, both SB and PB composite explain a significant amount of the variance in the PA trait, and PB composite contributes more to the variance of the dependent variable than does SB composite. In sum, participants exhibiting interpretation bias in the direction of paranoia and those exhibiting interpretation bias in the direction of social anxiety were both highly vulnerable to paranoia, while those with interpretation bias in the direction of paranoia were more vulnerable to paranoia.

Table 2.15 Statistical predictors of PT composite

	R	R ²	Adjusted R ²	Independent measures	B	Beta	t	Sig.
Model 1	0.51	0.26	0.2549**	PB	0.62	0.51	5.42	<0.01**
Model 2	0.55	0.31	0.2915**	PB	0.38	0.32	2.5	0.02*
				SB	0.42	0.29	2.29	0.03*
Adding SB increases the variance explained ($\Delta R^2 = 0.0366$)=3.66%								
Model 3	0.51	0.26	0.2462**	SB	0.73	0.51	5.30	0.001**
Model 4	0.56	0.31	0.2915**	SB	0.42	0.29	2.29	0.02*
				PB	0.38	0.32	2.50	0.01*
Adding PB increases the variance explained ($\Delta R^2 = 0.0687$)=4.53%								
Analysis summary: when controlling for the alternative bias more variance in PT was explained by PB (4.53%) than SB (3.66 %)								

Note: The dependent variable= the PA trait (PT) composite. *p <0.05, **p <0.01. ST= the composite of social anxiety trait measures: the SADS, LSAS, SIAS, and the SPS; PT= the composite of paranoia trait measures: the PS, GTPS, and the PDI; SB= the composite of negatively evaluated interpretation bias scores of the SST, SRT, and the WSAP; PB= the composite of persecutory interpretation bias scores of the SST, SRT, and the WSAP.

Taken together, both the SA and PB composites significantly predict SA trait composite. The SB composite was most heavily weighted in the predictive model. Similarly, both SA and PB composites were significantly associated with the PA trait composite, while the PB composite was weighted only slightly higher in the predictive model. Thus, both participants exhibiting negative interpretation bias and persecutory interpretation were highly vulnerable to social anxiety, while those exhibiting interpretation bias in the direction of social anxiety were more vulnerable. Likewise, participants with negative interpretation bias and those with persecutory interpretation were both highly vulnerable to paranoia, while those with interpretation bias in the direction of paranoia were more vulnerable.

2.4 Discussion

In this study, two related questions were addressed. First, consistent with the existing literature, the question of whether individuals with different levels of trait paranoia and social anxiety differ correspondingly in their interpretation of emotionally ambiguous information, was examined. Some of the ambiguous information was particularly relevant to social anxiety; other of it was more relevant to paranoia. Second, in this study, the central hypothesis of the thesis - whether there is a content-specific association of interpretation bias in relation to its content-congruent emotional traits - was examined. According to this hypothesis, negatively evaluated (social anxiety congruent content) interpretation bias will be more strongly associated with social anxiety than with paranoia. Conversely, persecutory (paranoia congruent content) interpretation bias will be more strongly associated with paranoia than with social anxiety. Three experimental cognitive tasks reflecting the same cognitive process (interpretation of ambiguity) were analysed separately, in order to address the first question, and were analysed by creating a composite in order to address the second question. Each question is discussed here in turn. Results are summarised in tabular form, then interpreted. Unanticipated findings, limitations and the implications of the study are discussed.

2.4.1 Analyses Driven by Previous Literature

Based on previous literature, we expected that individual differences in trait characteristics would be associated with corresponding differences in related interpretation biases; that is, that trait social anxiety would be more strongly associated with the negatively evaluated (social anxiety congruent content) interpretation bias than with the persecutory (paranoia congruent

content) interpretation bias. Conversely, trait paranoia would be more strongly associated with the persecutory (paranoia congruent content) interpretation bias than with the negatively evaluated (social anxiety congruent content) interpretation bias.

2.4.1.1 Summary and Interpretation of Results

Table 2.16 Summary of key findings

Dependent variables		Results	Does the corresponding trait better explain the variance in the related, (i.e. content matched) bias?
SRT	SB	SB was only explained by ST at 7.58%	YES
	PB	when controlling for the alternative traits more variance in PB was explained by PT (2.41%) than ST (-0.72%)	YES
SST	SB	when controlling for the alternative traits more variance in SB was explained by ST (4.71%) than PT (-0.04%)	YES
	PB	when controlling for the alternative traits less variance in PB was explained by PT (4.45%) than ST (10.14%)	NO
WSAP	SB	when controlling for the alternative traits more variance in SB was explained by ST (5.20%) than PT (-1.79%)	YES
	PB	when controlling for the alternative traits less variance in PB was explained by PT (2.48%) than ST (8.27%)	NO

Note: social anxiety content matches are shown on grey rows, and paranoid ones are shown on white rows. SB= negatively evaluated interpretation bias; PB= persecutory interpretation bias. SA trait measures= the SADS, LSAS, SIAS, and the SPS; PA trait measures=the PS, GTPS, and the PDI.

A summary of the key findings is presented in Table 2.16. The first question addressed was whether individuals with different levels of trait paranoia and social anxiety differ correspondingly in their interpretations of emotionally ambiguous information. In the test of negative evaluated interpretation bias (SB), we found that only the social anxiety trait explained the variance, while paranoia traits contributed nothing or weakened the model. Results across all three tasks confirmed what we proposed at the beginning: that trait social anxiety is more strongly associated with negatively evaluated (social anxiety congruent content) interpretation bias than with persecutory (paranoia congruent content) interpretation bias. Individuals vulnerable to social anxiety therefore prefer to interpret an emotionally ambiguous social

scenario in a negative rather than a persecutory way. This is consistent with the previous findings (e.g., Eysenck et al., 1991; MacLeod & Cohen, 1993; Calvo & Castillo, 1997; Beard & Amir, 2010). Using the most methodologically robust measure of interpretation bias, the SRT, Eysenck et al. (1991) conducted group analysis of participants whose scores ranged from none to severe anxiety on this scale. They found that anxious participants selected the negative (Calvo & Dolores Castillo, 2001) interpretation of an ambiguous scenario more often than did either non-anxious controls or recovered anxious participants. This was not, however, a direct test of social anxiety, and the group design of the experiment does not evidence a linear association between trait anxiety and the negative interpretation bias. Moreover, their analysis did not include a test of commonly comorbid emotional traits in the experiment. The results therefore do not directly address the content specificity of interpretation bias towards social anxiety as opposed to towards other emotional traits. Extending previous findings, our experiment showed promising results on the SRT and other two cognitive tasks: social anxiety vulnerable individuals generated more negative (social anxiety-congruent) interpretation bias of emotionally ambiguous information than did paranoia vulnerable individuals. Social anxiety levels exacerbate the negative interpretation bias: the more socially anxious one is, the more negative interpretation bias one generates. Content specific interpretation bias is thus clear in individuals vulnerable to social anxiety, as is a linear relationship between the trait of social anxiety and negative interpretation bias.

In the test of persecutory interpretation bias (PB), paranoia traits contribute significantly to the variance on one of three tasks; on the other two, social anxiety accounts for more of the variance than do paranoia traits. The most methodologically robust measure of interpretation bias, the SRT, supports the initial proposition: that paranoia is more strongly associated with persecutory interpretation bias than is negatively evaluated interpretation bias, consistent with previous findings of interpretation bias in paranoia (Savulich et al., 2015). Savulich et al. (2015) investigated the content specificity of interpretation bias in both regression design and group comparisons (high vs. low paranoid). The modified SRT was used to test positive/negative interpretations, and more/less paranoid interpretations. The regression results reveal that trait paranoia and trait anxiety predicted persecutory interpretation bias. In the group comparisons, although no clear content specificity in interpretation bias related to paranoia was found, the results did suggest that the group with high levels of trait paranoia generally made negative

interpretations. SRT results in the current study confirmed these findings. In addition, the content specificity of interpretation bias in paranoia was demonstrated. This also confirmed the original proposition of the study, that paranoia is more strongly associated with persecutory (paranoia congruent content) interpretation bias than with negatively evaluated (social anxiety congruent content) interpretation bias. The findings from the SST and WSAP were, however, unexpected. Results showed that individuals vulnerable to paranoia generated both negative and persecutory interpretation bias of emotionally ambiguous information, generating even less persecutory (paranoia-congruent) interpretation bias than social anxiety vulnerable individuals. Although this finding contradicts the proposed content specificity of persecutory interpretation bias, the notable contributions of trait social anxiety in predicting persecutory interpretation bias nevertheless support the cognitive model of paranoia (Freeman et al., 2002). High levels of pre-existing anxiety comorbid with social ambiguity constitute a particularly significant cognitive component of paranoid individuals: the cognitive content of anxiety centres on the fear of impending threat, later reflected in paranoid thought (Freeman et al., 2002).

How did single trait scores relate to bias task results? SPS and SIAS scores most efficiently predicted the negative (social anxiety congruent) interpretation bias, while PDI scores most efficiently predicted the persecutory (paranoia congruent) interpretation bias. What was unexpected was that the FNE was excluded from the regression model, owing to its negative correlation with most task scores. The SADS also yielded a contradictory result, in that its scores marginally predicted both negative and persecutory interpretation bias. Scores on the LSAS, PS and GTPS did not emerge as significant predictors in any of the task results.

2.4.2 Hypothesis-Driven Analyses

According to the key hypothesis of the thesis, a content-specific association between interpretation bias and its content-congruent emotional trait was proposed here. The hypothesis is therefore that the negatively evaluated (social anxiety congruent content) interpretation bias is more strongly associated with trait social anxiety than with paranoia. Conversely, the persecutory (paranoia congruent content) interpretation bias is more strongly associated with trait paranoia than with social anxiety.

Table 2.17 Summary of key findings

Dependent variables	Results	Does the corresponding bias better explain the variance in the related (i.e. content matched) traits?
SA trait	when controlling for the alternative bias more variance in ST was explained by SB (6.87%) than PB (2.60%)	YES
PA trait	when controlling for the alternative bias more variance in PT was explained by PB (4.53%) than SB (3.66 %)	YES

Note: social anxiety content matches are shown on grey rows, and paranoid ones are shown on white rows. Fenigstein PS SA trait= the composite of social anxiety trait measures: the SADS, LSAS, SIAS, and the SPS; PA trait= the composite of paranoia trait measures: the PS, GTPS, and the PDI; SB= the composite of negatively evaluated interpretation bias scores of the SST, SRT, and the WSAP; PB= the composite of persecutory interpretation bias scores of the SST, SRT, and the WSAP.

2.4.2.1 Summary and Interpretation of Results

According to the regression results of the social anxiety trait composite, the social anxiety bias composite was significantly associated with the social anxiety trait composite. After adding the paranoia bias composite, we found that both social anxiety and the paranoia bias composites were significantly associated with the social anxiety trait composite. This suggests that participants were vulnerable to social anxiety, regardless of the interpretation bias content (negatively evaluated or persecutory) they produced.

Further, the positive Δ Adjusted R^2 change value extended our conclusions. There was a higher significance level and a greater Δ Adjusted R^2 value after controlling for paranoia bias composite, when testing the relationship between social anxiety bias composite and its content congruent trait composite. This finding strengthens the association between the social anxiety bias composite in predicting its content congruent trait composite. It suggests that participants were more vulnerable to social anxiety when they produced more negatively evaluated interpretation than when they produced persecutory interpretation.

The regression results of the paranoia trait composite showed that the paranoia bias composite was significantly associated with the paranoia trait composite. After adding the social anxiety bias composite, we found that both social anxiety and paranoia bias composites were significantly associated with the paranoia trait composite. This suggests that participants were

vulnerable to paranoia regardless of the interpretation bias content (negatively evaluated or persecutory) they produced.

In addition, the positive Δ Adjusted R^2 change value extended our conclusions. There was a strengthened significance level and greater Δ Adjusted R^2 value after controlling for social anxiety bias composite, when testing the predictive relationship between paranoia bias composite and its content congruent trait composite. This finding enhanced the association of the paranoia bias composite in predicting its content congruent trait composite, suggesting that participants were more vulnerable to paranoia when they produced more persecutory interpretations than when they produced negatively evaluated interpretations.

The second addressed question was whether there is a content-specific association of interpretation bias in relation to its content-congruent emotional trait. The results support the hypothesis. There were associations between social anxiety bias composite and its content-matched trait composite and associations between the paranoia bias composite and its content-matched trait composite. Although direct evidence of a content-specific predictive relationship between interpretation bias and the emotional trait is lacking, owing to the cross-sectional nature of the study, the results of comparing the linear relationship of different interpretation content (negatively evaluated versus persecutory) and its content matched traits was promising. Participants were more vulnerable to social anxiety when they produced negatively evaluated as opposed to persecutory interpretations of emotionally socially ambiguous information, while participants were more vulnerable to paranoia when they produced persecutory interpretations as opposed to negatively evaluated interpretations.

Overall, our results support cognitive theories of psychopathology (Beck, 1971; Williams et al., 1988; Eysenck et al., 1991), indicating that, at a subclinical level, each emotional trait can be characterised by a cognitive bias content specific to that trait. By comparing different contents (negatively evaluated/persecutory) of interpretation bias that show a match the relevant emotional vulnerability (social anxiety/paranoia) to a greater or lesser extent, it emerged that negatively evaluated (social anxiety congruent content) interpretation bias matches social anxiety better than paranoia. Conversely, the persecutory (paranoia congruent content) interpretation bias more closely matched paranoia than social anxiety.

2.4.2.2 Unexpected Findings and Possible Explanations

Although the results were promising, the significant contribution from the “content-unmatched” interpretation cannot be ignored. For example, in the predictive model of social anxiety, not only negatively evaluated interpretation but also persecutory interpretation contributed significantly, similar to the prediction of paranoia. These question the discriminant validity of task items of interpretation and trait measures. First, participant ratings on possible interpretations were not based on a direct comparison between a negatively evaluated and persecutory interpretation. Each of our tasks presented different interpretations by showing two separate versions (social anxiety/paranoia). For example, participants could only select between a negatively evaluated and a neutral interpretation in the social anxiety version, and between a persecutory and a neutral interpretation in the paranoia version. Their choice was not between a negatively evaluated or persecutory interpretation. A proportion of participants might always choose a threatening interpretation, selecting negatively evaluated interpretations in the social anxiety version, and persecutory evaluated interpretations in the paranoia version. The even preference for non-neutral interpretations would then lead to poor discriminant validity. Second, the same problems were considered in trait measures. Current models of social anxiety and paranoia suggest that these two constructs are conceptually related and co-occur meaningfully. Although our correlation analysis of trait measures showed it was feasible to assess social anxiety and paranoia as different constructs, a number of items from one trait measure were still endorsed by individuals high on the other trait. For example, the item “I have often felt that strangers were looking at me critically” from the Self-report Paranoia Scale (Fenigstein & Venable, 1992) also has a socially anxious meaning. Perceiving others as critical towards them is typical of socially anxious individuals (Hirsch & Clark, 2004). It was difficult to find measures that discriminated well between the traits of social anxiety and paranoia.

2.4.3 Limitations

The results confirm a content specific (negatively evaluated) interpretation bias in socially anxious individuals. Further, they confirm its association with the social anxiety trait. However, the results for persecutory interpretation bias were less conclusive. Although an association of content specific interpretation bias towards the paranoid trait was confirmed, only SRT revealed a content specific interpretation bias in paranoid individuals. Unexpectedly, the SST and WSAP failed to yield a content specific interpretation bias, but both found significant negatively

evaluated and persecutory interpretation biases in paranoid individuals. The negatively evaluated interpretation was weighted slightly more heavily.

First, the inconsistent results brought into question the efficacy of some of the tasks in differentiating the two interpretation biases. For example, SST and WSAP results showed that paranoid participants tend towards both negatively evaluated interpretation and persecutory interpretation, slightly favouring the negatively evaluated one. Although this result did not support our content specific hypothesis, one could argue that it constitutes an actual representation of the paranoid individuals. This is consistent with the cognitive theory proposed by Freeman et al. (2002), according to which paranoia is based upon common, socially emotional concerns. They suggest that high levels of pre-existing anxiety and distress coexisting with social ambiguity is a particularly salient cognitive component of paranoid individuals. The cognitive content of anxiety centres upon impending threat, which may later manifest as paranoia thought (Garety, Kuipers, Fowler, Freeman & Bebbington, 2001). Moreover, their hierarchy of paranoia ranged from the mild end of social evaluative concerns (e.g., fears of criticism) to the severe end of life threatening concerns (e.g., fear of harm) (Freeman et al., 2005). The mild end of paranoia might interact with the negatively evaluated interpretation bias, typically accompanied by social anxiety. Nevertheless, the SRT did demonstrate a content specific interpretation bias in paranoia, which balanced our findings, and supported our hypothesis. Overall, the results fail to yield consistent findings of content specific interpretation bias in paranoia; its cognitive overlap with social anxiety is, however, confirmed.

Second, some of the tasks might lack interference controls in the pre- and post-information process of interpretation. For example, both the SST and the WSAP used a “word” format stimulus (e.g., unhelpful/constructive, sabotage/support) to represent the biased interpretation. First, one could argue that responses might easily be interfered with by selective attention. Rather than generating an interpretation, participants might quickly choose what negatively attracted their attention. However, this was extended to the edge of interpretation bias we tested: even the positive results our finding. However, the SRT showed that the interpretation bias of target stimuli (negative and related in meaning to the ambiguity) was much higher than the foil stimuli (negative but unrelated in meaning to the ambiguity), confirming that the results were not due to the response bias. Second, one’s pre-existing negative ideation of social

ambiguities might be another factor affecting the interpretation process. Rather than a direct interpretation of social scenarios, socially anxious individuals rely upon pre-existing negative ideation to resolve ambiguity (Beard & Amir, 2010b). Hemsley (1998) also suggested that poor use of contextual information can disrupt one's ability to process ongoing information. However, the WSAP present primes representing persecutory/negatively evaluated interpretations before the ambiguous stimuli have better imitated the priming effects of pre-existing ideation on interpretation processes. Overall, using different tasks to measure interpretation bias balanced the weaknesses of each task. The results from composites across different tasks enhanced our findings.

Third, there was arguably a lack of direct comparison of negatively evaluated interpretation and persecutory interpretation. For example, there were two separate versions for each of the cognitive tasks: one version represented a negatively evaluated and benign interpretation; the other represented persecutory and benign interpretation. That is, the selection that a participant made was from negative or benign rather than negative or persecutory. The conclusion with regard to content specificity is thus an indirect finding. Tasks that represent negatively evaluated interpretation and persecutory interpretation at the same time are preferable.

Fourth, response bias was not considered in the SST and WSAP. Participants might only have responded to the non-positive/benign stimuli, not actively differentiating between negative and persecutory meaning. Moreover, the paranoia related interpretations that reflected the idea of reference shared common content with negatively evaluated interpretations. The SRT was the only task that distinguished the idea of reference interpretation from persecutory interpretation in items, which the SST and WSAP were not. This might have weakened the sensitivity of the test in persecutory (paranoia related) interpretation bias from negative evaluated (social anxiety related).

Fifth, screening participants for a wide range representation of emotional trait scores is also a potential limitation. Participants were screened for a normal distribution on trait scores to form the testing sample. This was to ensure the sample would not be overloaded with any specific range of individuals. One might argue that the sample are more likely to be representative of the population if we did not screen out any participants. However, the normal distributed sample is essential for the correlation analysis of this study. Analysis based on abnormal distributed data

may result in substantial distortions of parameter and statistic estimates. The results based on this analysis may not well present the actual trend in a wide range of population, but only the weighted majority. Future study may explore same research topic on each specific range of population.

Finally, the cross-sectional design of this experiment could arguably limit the extent to which inferences can be drawn from regression models. The predictive relationship and content specificity were only the outcome in a time of the relationship between the tested variables; a causal conclusion of the content-specificity of emotional trait and interpretation bias cannot be drawn based on these results. Additional longitudinal studies are therefore essential.

2.4.4 Implications

The experiment has theoretical implications for cognitive models of paranoia and social anxiety. First, the content specificity of interpretation bias in relation to paranoia could be examined in future studies. By controlling for negatively evaluated bias and preventing it from confounding persecutory bias, it appears that social anxiety related cognitive content plays a critical role in the statement of trait paranoia. Second, this is consistent with the cognitive model (Freeman et al., 2002) in its direct link of paranoia and the reflection of emotions, which confirmed the role of social anxiety in persecutory beliefs. Other comorbid emotional vulnerability should be considered in building up detailed structures of the formation and maintenance of paranoia. Moreover, future research could examine in which stage of social interactions biased interpretations occur or dominate, and the differences between paranoia and social anxiety. For example, by providing interpretations prior to social ambiguity, the results of the WSAP suggest that an instant, negatively evaluated interpretation dominates both social anxiety and paranoia. Conversely, by providing interpretations after the social ambiguity, the results of SRT revealed only persecutory interpretations in paranoia, and that negative interpretations dominate social anxiety. This implies that different directions of the interpretation may apply differently when a paranoid participant encounters social ambiguities. For instance, both negatively evaluated and persecutory interpretations dominate pre-existing beliefs (prior to entering a social ambiguity), while only persecutory interpretations are produced when encountering social ambiguity. Finally, the current findings might be extended in future studies by examining the role of interpretation bias in predicting future levels of emotional distress, such as in depression and distress (e.g.,

Rude et al., 2002; Pury, 2002). Although our results were unable to suggest any causal role for content specific interpretation bias in developing paranoia or social anxiety, there were promising findings that clearly indicated the direction of interpretation biases in content specific emotional traits. A longitudinal design may therefore be applied in future research.

Our results also have practical implications for clinical interventions in paranoia and social anxiety. First, interventions of paranoia may be more effective if they recognise the ubiquity of trait social anxiety. Although it is much more common now to consider the particular association of anxiety, distress and social isolation in the development and maintenance of paranoid ideation in Cognitive Behavioral Therapy (CBT) (Kuipers et al., 2006), our results suggest a direction of attention to a particular anxiety subtype (social anxiety) for interventions in paranoia. For example, introducing scheduled behavioral therapies to interrupt the cycle of social anxiety and distress might improve affect and social support and reduce isolation. Moreover, it is important to apply interventions to reduce interpretation bias; on acknowledgment and training, such positive or unthreatening interpretations become credible. For example, introducing Cognitive Behavioral Modification (CBM) procedures using a computer-based technique to assist in reducing interpretation bias by the repetitive practice of alternative positive interpretations of emotional ambiguities. Negative information processes are the main focus in anxiety (e.g., Brosan et al., 2011), social anxiety (Turner et al., 2011), depression (Lee et al., 2015) and paranoia (Savulich, Shergill & Yiend, 2015). Here, the possibility of more attention to interpretation bias is suggested and the focus on reducing negative interpretation bias extended to a wider range of comorbid trait congruent interpretations. For example, both paranoia and social anxiety congruent interpretations could be targeted in cognitive interventions for paranoia.

2.5 Conclusion

Consistent with the existing literature, this study confirmed a content specific (negatively evaluated) interpretation bias in socially anxious individuals. Results of the most methodologically robust measure of interpretation bias, the SRT, confirmed the content specificity of interpretation bias in paranoid individuals. With respect to the main research question here, a significant association was demonstrated between interpretation and its content specific emotion (paranoid/social anxiety) trait. Overall, the results of this cross-sectional experiment generated promising findings relevant to the subclinical population. The

next experiment may extend these findings by demonstrating the content specificity of interpretation bias in a forced alternative design, facilitating a direct comparison between the two interpretation biases.

Chapter 3 Experiment 2: The Content Specificity of Interpretation Bias in Social Anxiety and Paranoia

3.1 Experiment Overview

The findings of Experiment 1 revealed content specificity for interpretation bias in socially anxious and paranoid individuals: they were biased in the direction of the emotional concerns related to their psychopathological trait (Mathews & MacLeod, 1994). Both socially anxious and paranoid individuals interpret emotionally social ambiguities in a biased way: socially anxious individuals experience themselves as negatively evaluated; paranoid individuals, as persecuted. Biased interpretation is an important aetiological factor in the development and maintenance of affective disorders (Clark & McManus, 2002), and paranoid psychosis (Freeman et al., 2008). Recent studies reveal the clinical potential of early identification and induction, which may improve mood and ameliorate symptoms (Lester et al., 2011; Yiend et al., 2014). In this experiment, a cross-sectional design is applied in a broad population in order to examine the content specificity of biased interpretations associated with social anxiety and paranoia. Three cognitive experimental tasks are used to test two alternative forced choice designs (Bogacz et al., 2006) with either socially anxious or paranoid congruent content. Rather than presenting each task with separate versions of negative (social anxiety trait matched)/benign content or persecutory (paranoia trait matched)/benign content, here participants are forced to make a two-alternative selection between socially anxious or paranoid interpretation on SST and RJT task, or rate without benign content but only interpretation of socially anxious/paranoid contents. An ambiguous stimulus (e.g., a stranger is standing across the street) is presented with a negative (social anxiety congruent) interpretation, such as “the stranger is laughing at me”, and a persecutory (paranoia congruent) interpretation, such as “the stranger is stalking me”. Hierarchical regression analysis is used to examine the content-specific association between interpretation biases and social anxiety/paranoia.

3.2 Background

Affective disorders can be characterised by cognitive content specific to that disorder (Beck, 1971). The cognitive processes of a socially anxious individual, including interpretations,

attention and imagery, thus center on the theme of being negatively or threateningly evaluated by others (Foa et al., 1996). Paranoia is characterised by the theme of persecutory beliefs: a misinterpretation of experiences as posing either a psychosocial or physical threat, and an overestimation of both the intensity and probability of anticipated harm in ambiguous situations (Freeman et al., 2002). Emotionally ambiguous information may have positive or negative emotional consequences. For example, one might experience the whisper of a stranger as praise or disrespect, thus experiencing either encouragement or distress (Savulich et al., 2015). Psychologically vulnerable individuals often generate biased interpretations when dealing with such information (Beck, 1971). Interpretation bias is the tendency to interpret information consistently with one's pre-existing beliefs or hypotheses, rather than considering alternative explanations. Biased interpretations facilitate the endorsement of emotionally threatening content, reinforcing pathological emotional traits (Murphy et al., 2007; Wilson et al., 2006). The content of biased interpretation is central to the cognitive theory of psychopathology in social anxiety and paranoia.

According to the content-specificity effect, the concerns of psychologically vulnerable individuals consist primarily of emotional information that matches the core symptoms of a psychopathology (Beck, 1971). The more highly the match is prioritised, the more likely it is that the pathology and its emotional trait will be maintained (Mathews & MacLeod, 2002). Paranoid individuals are concerned primarily with suspicious information, which maintains their paranoia; socially anxious individuals maintain schemas of negative evaluative information, which maintains their social anxiety. Beck et al. (1971) tested the content-specificity hypothesis of their proposed cognitive psychopathological model in depression and anxiety. Depressed and anxious patients were asked to rate the frequency of a pool of cognitive statements reflecting anxiety (e.g., I won't know what to say) or depression (e.g., I'm a social failure). The findings firmly supported the content-specificity hypothesis of the cognitive model of psychopathology. Another multiple regression study confirmed this finding: beliefs of failure (depressed cognition) are specially associated with depression; beliefs of threat, uniquely predictive of anxiety (Clark, Beck & Brown, 1989). Based on regression design, Alford et al. (1995) suggested a predictive role for distinct cognitive content in specific psychological disorders, while Greenberg and Beck (1989) confirmed content specificity in a group design study. By contrast, in a study of young anxious and depressed patients, Laurent and Stark (1993) did not find sufficient support for

content specificity: participants differed only on depressed and not on anxious cognition. Beck et al. (1987) identified both disorder-specific and shared cognitive concerns, suggesting that the disorders are both distinct and related in longitudinal data. Extending these findings with a focus on general cognitive content, research further suggests that content specificity occurs at the product level of information processing, such as interpretations and beliefs (Lamberton & Oei, 2008). A meta-analysis of the content specificity of attention bias in anxiety indicated that attention bias is more closely associated with disorder-congruent than -incongruent threat stimuli (Pergamin-Hight et al., 2015). To date, most cognitive content specificity research has focused on affective disorders, and not on psychosis. Savulich et al. (2012) proposed the theoretical importance of cognitive content specific bias in the development and maintenance of paranoid psychosis and found moderate evidence of the cognitive content specificity of psychopathology in paranoia, in that negative bias was related to paranoia (Savulich et al., 2015). However, the cognitive mechanism informing this specificity remained unclear.

Most content specificity tasks were developed for a general cognitive process; fewer focus specifically on interpretation. Beck (1987) used a cognition checklist to measure the content specificity of general cognition. Cognitive content was presented as sentences (e.g., people will reject me), extracted from encounters typical of the disorders. Participants rated how often those cognitive contents occurred to them in the context of a specific situation (e.g., physical/social). Similar questionnaires have been developed to test anxiety-related cognition, such as the Anxious Self-Statements Questionnaire (Kendall & Hollon, 1989) and depression-related cognition, such as the Automatic Thoughts Questionnaire (Hollon & Kendall, 1980). Studies of interpretation bias typically employ the similarity rating task (Eysenck et al., 1991) and the scramble sentence task (Wenzlaff, 1993). Focusing on the content specificity of interpretation bias, Savulich et al. (2015) used three cognitive measures to test groups of participants ranging from non-paranoid to paranoid. The similarity rating task is the most methodologically robust task of interpretation bias. An emotionally ambiguous passage describing commonly experienced social scenarios is presented. Participants are asked to rate how similar the disambiguated sentences are to the original text passage. Paranoid or non-paranoid interpretations are presented in one set of material, and positive or negative interpretations in another. Results revealed only a general negative interpretation bias with no clear content specificity in paranoia. The Scrambled Sentences Task (SST; Savulich et al.,

2015), in which participants unscramble sentences with target words representing paranoid/non-paranoid or negative/positive meaning, indicated a higher degree of content specificity: trait paranoia was associated only with paranoid interpretation bias and not with negative interpretation bias. Content specificity was also not observed on the facial emotion recognition task; associations between emotion recognition and paranoia were limited. However, none of above tasks tests content specificity directly, by providing alternative target interpretations in one set of material; for example, presenting anxiety-related interpretations with paranoia-related interpretations rather than in separate sets. Moreover, although a number of studies investigated the content specificity of different affective disorders, none included psychiatric disorders. Paranoia and socially anxiety are highly comorbid in the prodromal stage of psychosis, and their cognitive content specificity might play a crucial role in the development and maintenance of related emotional traits and disorders.

In the current experiment, the content specificity findings of Experiment 1 were tested. Three paradigms, the Similarity Rating Task (SRT), the SST (Husstedt et al., 2002) and the Relatedness Judgment Task (RJT; Savulich & Yiend, 2012) were developed to test interpretation bias in paranoia and social anxiety. The design of this experiment differs from that of Experiment 1 in three respects. First, rather than completing tasks with separate sets of paranoia/positive or social anxiety/positive stimuli, Experiment 2 presents only socially anxious or paranoid interpretations without positive alternatives for participants to select or rate. This allowed for a direct test of content specificity of interpretation bias in paranoia and social anxiety and represents a main strength of the study. Participants directly compared social anxiety and paranoia related interpretations and made selections. Second, the image-based RJT was used in order to enrich the testing dimensions, revealing whether the content specificity of interpretation bias applies to media other than text. Data analysis is similar to in Experiment 1. First, the data is analysed following the precedent set in the literature, comparing the interpretation content of individuals with different emotional traits (e.g., anxiety/depression). This classical design allows a direct test of the content specificity of interpretation bias, whereby anxious individuals produce more anxiety-related (trait-matched) interpretation bias than do depressed individuals, and vice versa. Interpretation bias is used as the dependent variable, testing its content-specific association to related emotional traits. Confirming whether the current results are consistent with the literature is fundamental here. The proposed aetiological

role of content specificity in interpretation bias has been developed from the following theoretical rationale: if individuals with different emotional vulnerabilities differ in their emotionally congruent interpretation biases, such bias might predict bias-congruent emotional traits. The major research interest here is the aetiological importance of interpretation bias in identifying corresponding emotional traits. Although it is impossible to test the aetiological role of interpretation bias using a cross-sectional design, content-specific interpretation bias in social anxiety and paranoia is investigated.

Our hypothesis is stated in two parts:

Part 1: Testing the precedent in the literature: there is a direct content-specific association of emotional traits and their trait-congruent interpretation bias.

- I. Social anxiety is more strongly associated with negatively-evaluated (social anxiety congruent content) interpretation bias than is paranoia.
- II. Conversely, paranoia is more strongly associated with persecutory (paranoia congruent content) interpretation bias than is social anxiety.

Part 2: Testing the major research interest of the project: there is content-specific association of interpretation bias and content-congruent emotional traits.

- III. Negatively-evaluated (social anxiety congruent content) interpretation bias is more strongly associated with social anxiety than is persecutory (paranoia congruent content) interpretation bias.
- IV. Conversely, persecutory (paranoia congruent content) interpretation bias is more strongly associated with paranoia than is negatively evaluated (social anxiety congruent content) interpretation bias

3.3 Methods

3.3.1 Experimental Design

In a design similar to Experiment 1, 80 participants were administered self-report personality questionnaires in order to measure emotional traits. Cognitive tasks were used to test interpretation bias. The major differences in experimental design included using the RJT instead of the Word Sentence Association Task and using a two-alternative forced choice design on

each participants had to choose between paranoid and social anxious interpretation rather than selecting between benign and paranoid interpretations or benign and socially anxious interpretations.

3.3.2 Participants

80 non-clinical volunteers (65 female, 15 male) were eligible for participation and completed all experiment procedures. Participants consisted mainly of students and staff at King's College, London, and were recruited by circular email after meeting inclusion criteria for the study. The inclusion criteria were (a) being over 18 years of age, (b) fluent in English and (c) not having been diagnosed with any psychological or psychiatric disorder and not currently receiving treatment for any psychological or psychiatric disorders, including psychopharmacological medication. Participants were predominantly Caucasian ($n = 50$), with the sample also including participants of Asian ($n = 6$), Black/African/Caribbean ($n = 10$) and other ($n = 14$) origins. Ages ranged from 18 to 41 years ($M = 25.82$, $SD = 6.17$). The educational attainments of participants ranged from high school ($n = 6$) to university ($n = 73$).

3.3.3 Recruitment

Participants were selected to have wide-ranging scores on the Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998) and the Self-report Paranoia Scale (Fenigstein & Venable, 1992). Eligible participants were invited to participate using the contact details provided.

3.3.4 Materials

3.3.4.1 Measures of Emotional Traits

The Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987), SIAS (Mattick & Clarke, 1998) and Social Phobia Scale (SPS; Mattick & Clarke, 1998) were used to measure social anxiety. The Fear of Negative Evaluation Scale (FNE) and Social Avoidance and Distress Scale (SADS; Watson & Friend, 1969) were excluded. In Experiment 1, these two measures were inefficient in distinguishing the two emotional traits: the FNE was not correlated with any of the cognitive tasks; the SADS correlated with tasks related both to social anxiety and paranoia. The Green Paranoid Thought Scales (GPTS; Green et al., 2008), self-report Paranoia Scale (PS; Fenigstein & Venable, 1992) and Peters Delusions Inventory (PDI; Peters et al., 1999) were used to measure paranoia.

Social anxiety

The LSAS (Liebowitz, 1987) has been widely used to assess a full range of performance and social difficulties in people with social anxiety disorder. It includes two subscales, which yield indices of fear and avoidance of social interaction (11 items) and performance (13 items). Each is measured on a four-point scale, ranging from 0 to 3. Scores indicate how participants have felt over the previous weeks, with higher scores indicating greater anxiety.

The SIAS (Mattick & Clarke, 1998) consists of 20 items and is scored on a five-point Likert-type scale, from 0 (not at all characteristic of me) to 4 (extremely characteristic of me), assessing anxiety related to initiating and maintaining interactions with people in social situations.

The SPS (Mattick & Clarke, 1998) was designed to assess anxiety symptoms related to performing various tasks (writing, drinking and eating in public) while observed by others. It consists of 20 items. Each SPS item is rated on a five-point Likert-type scale ranging from 0 (not at all characteristic or true of me) to 4 (extremely characteristic or true of me).

Measures of paranoia

The GTPS (Green et al., 2008) include two subscales and assess ideas of social reference and persecution, rated on a five-point Likert-type scale ranging from 1 (Not at all) to 5 (Totally). Four items from each dimension (conviction, preoccupation and distress) were chosen and four items simply reflecting a statement of a paranoid thought.

The PS (Fenigstein & Venable, 1992) was designed to measure the incidence of paranoia in a non-clinical college population. Participants rate their agreement with each of 20 items on a five-point scale (1 = not at all applicable, 5 = extremely applicable). The total score can range from 20 to 100; higher scores indicate greater paranoid ideation. This scale is the most widely used dimensional measure of paranoia.

The PDI (Peters et al., 1999) is a behavioural measure used to assess delusional ideation in the general population, and includes measures of distress, preoccupation and conviction.

3.3.4.2 Tasks of Interpretation Bias

Three cognitive experimental tasks were used to measure interpretation bias: the SRT, the SST and the RJT. Both the SRT and RJT are computer-based; the SST is a pen-and-paper task.

The Similarity Ratings Task (SRT; based on Eysenck et al. 1991)

The SRT, originally developed by Eysenck et al. (1991), is purportedly the most methodologically robust measure of interpretation bias (Savulich, Shergill, & Yiend, 2015). Participants are required to interpret emotionally ambiguous passages of text, which represent both paranoid and social anxiety related scenarios. Participants are presented with 20 ambiguous scenarios, each ending in a word fragment. An example of a scenario used in the task is the following:

Lecture

You are required to attend a Statistics lecture twice a week. You enjoy sitting with a group of friends you made last term. You greet them all but one of them does not answer b-ck [back].

Once the word fragment is correctly completed, participants are asked a comprehension question about the scenario ("Are you attending a lecture?"), and respond by pressing Y for yes or N for no on the keyboard. Following their response, a correct or wrong answer message is displayed on the screen. In the second part of the SRT, the titles of each scenario (e.g., Lecture) are presented with four possible interpretations: two target interpretations, with content relevant to the previous passage, and two foil interpretations, with content irrelevant to the previous passage. Interpretations are either positive or benign explanations of the scenarios. Participants are asked to rate how similar in meaning each sentence is to the original scenarios, on a four-point scale (1= very different in meaning, 4 = very similar in meaning). The SRT takes approximately twenty minutes to complete.

The SRT used in this study was based on the version used in Experiment 1. In Experiment 1, following the example above, a paranoid target interpretation was presented (e.g., Your friend in the Statistics lecture is deliberately snubbing you), and a benign interpretation (e.g., Your friend did not hear you), testing persecutory interpretation bias. In another set, a socially anxious target interpretation (e.g., Your friends are criticising your birthday plans) and a benign interpretation (e.g., Your friends are planning a surprise party) are presented, testing negative interpretation bias. However, in this experiment, we extend the SRT in Experiment 1 by presenting both a persecutory (reflecting paranoia) and negative (reflecting social anxiety)

interpretation in one single task set. Following the example above, four possible interpretations are presented (see Figure 3.1). This forced choice task design allows a direct test of content specificity in the two interpretations. It shows how participants interpret the social ambiguity if only negative and persecutory explanations are presented.

Figure 3.1 Example items of SRT in Experiments 1 and 2

SRT used in Exp 1	SRT used in Exp 2
<p>Set 1: testing persecutory interpretation Lecture</p> <p>You are required to attend a Statistics lecture twice a week. You enjoy sitting with a group of friends you made last term. You greet them all but one of them does not answer b-ck [back].</p> <p>5) Your friend in the Statistics lecture is deliberately snubbing you - target persecutory interpretation</p> <p>6) Your friend did not hear you - target benign interpretation</p> <p>7) Your friend in the library is distracted you - foil paranoid interpretation</p> <p>8) Your friend in the library didn't hear you - foil negative interpretation</p>	<p>Testing persecutory interpretation and negative interpretation Lecture</p> <p>You are required to attend a Statistics lecture twice a week. You enjoy sitting with a group of friends you made last term. You greet them all but one of them does not answer b-ck [back].</p> <p>1) Your friend in the statistics lecture is deliberately snubbing you - target persecutory interpretation</p> <p>2) Your friend in the statistics lecture thinks you are worthless - target negative interpretation</p> <p>3) Your friend in the library is distracted you - foil paranoid interpretation</p> <p>4) Your friend in the library didn't hear you - foil negative interpretation</p>
<p>Set 2: testing negative interpretation Local pub</p> <p>You have just moved to a new area and your neighbour asks if you would like to go to your local pub that evening. When you arrive, they are not yet there. You imagine what they think about you after your earlier c-nvers-t-on [conversation]</p> <p>5) After your earlier conversation, they probably thought you were likeable. - target negative interpretation</p> <p>6) After your earlier conversation, they probably thought you were dull. - target benign interpretation</p> <p>7) You find the new area pleasant - foil negative interpretation</p> <p>8) You find the new area unpleasant - foil benign interpretation</p>	

Note: Negative interpretation reflects a social anxiety related meaning; persecutory interpretation reflects a paranoia related meaning; benign interpretation reflects a neutral meaning, to which most of the healthy population subscribed

The Scrambled Sentences Task (based on Wenzlaff & Bates, 1998)

The SST used for this study was a modified version of the original task developed by Wenzlaff and Bates (1998), which assesses the tendency to interpret ambiguous information in positive or negative ways. The SST used here was based on the version used in Experiment 1. There were two sets of materials in Experiment 1. In each, participants were asked to rearrange a group of mixed up words, which had two possible solutions. A paranoid or benign interpretation in one set of SST tested persecutory interpretation bias; a socially anxious or benign interpretation in the other tested negative interpretation bias. However, in this experiment, we extend the SST in Experiment 1 by presenting both persecutory (reflecting paranoia) and negative (reflecting social anxiety) interpretation in one single task set. This required participants to rearrange mixed up words with two possible solutions, a paranoid or socially anxious interpretation. Participants had to unscramble five words to form grammatically correct sentences, placing a number over each of the five words to indicate the order of the words. 20 items were developed with each scrambled sentence containing a word that reflected paranoia (persecution), such as "stalking", and another that reflected social anxiety (negative evaluation by others), such as "disapproving". "Feel tend I disliked watched to" is an example of an item used on this version of the SST; this sentence could be disambiguated towards either a socially anxious ("I tend to feel disliked") or a paranoid ("I tend to feel watched") interpretation. Participants attained scores reflecting social anxiety bias and paranoia bias, based on whether they disambiguated sentences to form statements that matched the original sentences.

Figure 3.2 SST example items in Experiments 1 and 2

SST used in Exp 1		SST used in Exp 2
Set 1: testing persecutory interpretation Scrambled words: feel tend I welcomed watched to ↓ I tend to feel watched - negative statement I tend to feel welcomed - benign statement		Testing persecutory interpretation and negative interpretation Scrambled words: feel tend I disliked watched to ↓ I tend to feel disliked - negative statement I tend to feel watched - persecutory statement
Set 2: testing negative interpretation Scrambled words: usually most like people me dislike ↓ Most people usually dislike me - negative statement Most people usually like me - benign statement		


Note: Negative statement reflected social anxiety related meaning; persecutory statement reflected paranoia related meaning; benign statement reflected a neutral meaning, to which most of the healthy population subscribed

The Relatedness Judgment Task (Savulich & Yiend, 2012)

In the RJT, participants are asked to judge whether a picture was related to the sentence that followed. It consists of 20 items, and takes approximately 20 minutes to complete. For 15 of the items, participants are presented with a choice of two sentences reflecting a paranoid or socially anxious interpretation and asked to rate how similar each individual sentence is to its associated picture, on a four-point scale (1 = very similar, 4 = very dissimilar). Pictures were chosen to reflect either a paranoid or socially anxious interpretation. A benign choice was added to the final five items to identify participants who still endorsed a paranoid or socially anxious interpretation, even when a benign choice was available.

Figure 3.3 Example item of RJT in Experiment 2

Two of your coworkers are talking about something....



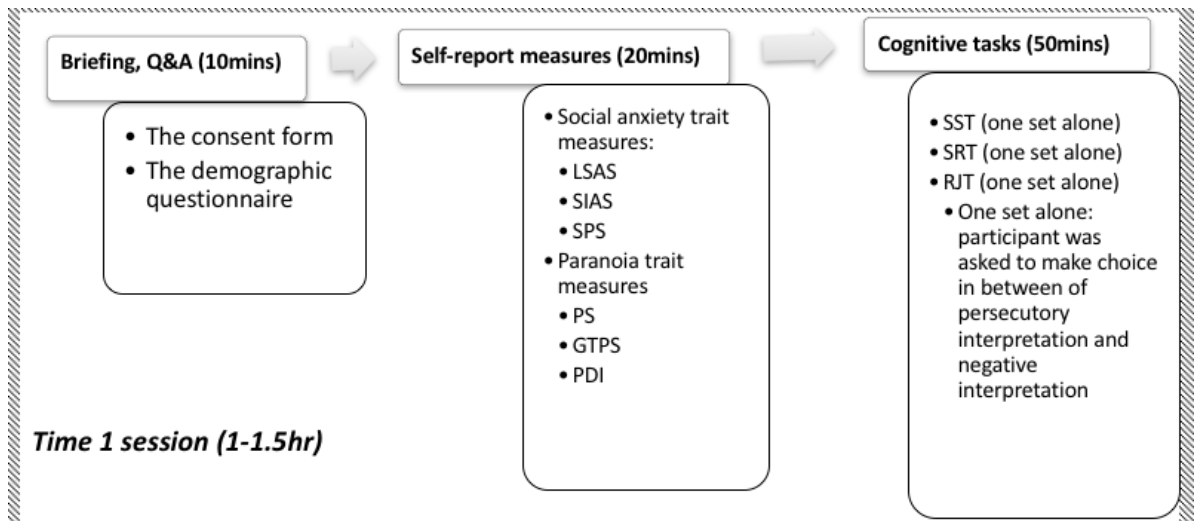
A. They are plotting against me

B. They are criticising me

3.3.5 Procedure

An experimental session lasts approximately one to one-and-a-half hours. All participants were reminded of the inclusion criteria before starting. As shown in Diagram 1, they were then asked to complete the consent form and the demographic questionnaire, followed by the self-report measures. This took approximately 20 to 30 minutes. To measure interpretation bias for negative (social anxiety related) and persecutory (paranoia related) interpretations, three cognitive experimental tasks were administered. Self-report measures and tasks were presented in counterbalanced, fixed order across participants. A random/counterbalanced design reduces the chance of order effects and other confounding variables.

Figure 3.4: Experimental procedure

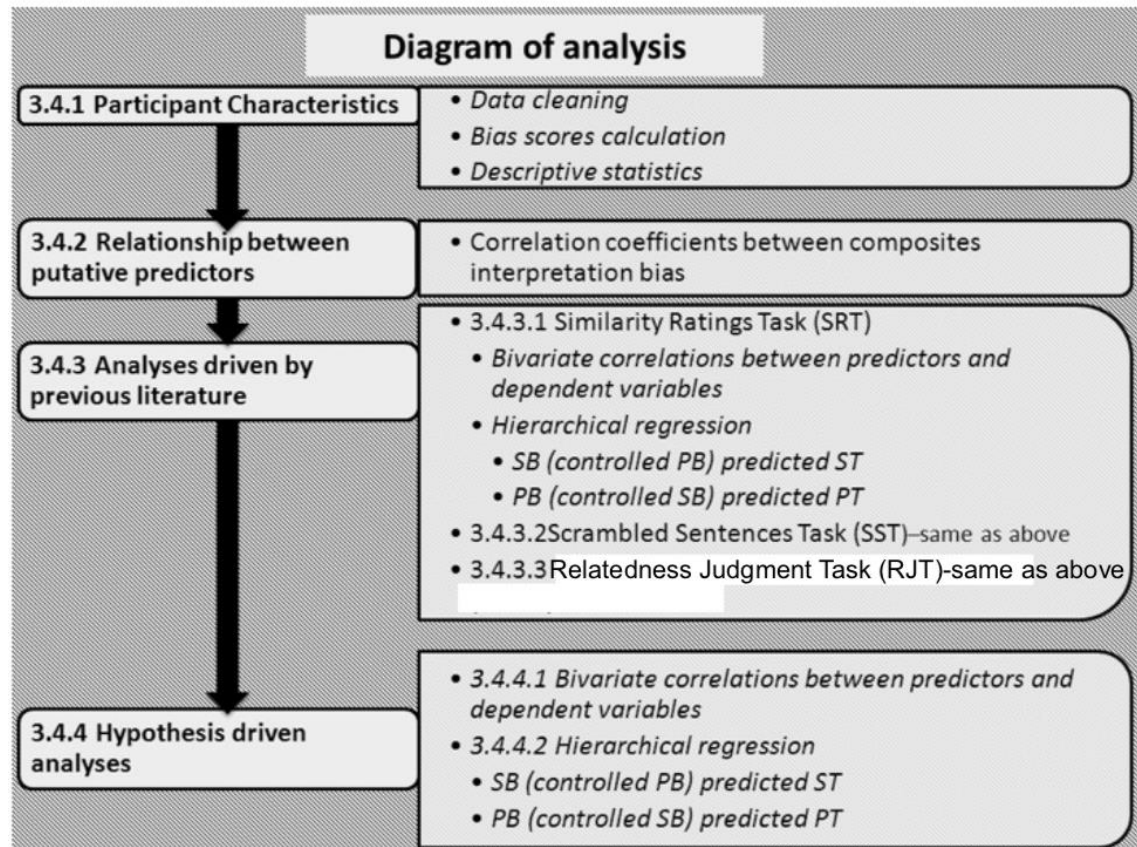


Note: Self-report measures were presented to participants before the tasks, in countbalanced, fixed order. LSAS (Liebowitz, 1987); SIAS (Mattick & Clarke, 1998); SPS (Mattick & Clarke, 1998); GTPS (Green et al., 2008); PS: Self-report Paranoia Scale (Fenigstein & Venable, 1992); PDI (Peters et al., 1999); SRT (based on Eysenck et al. 1991); SST (based on Wenzlaff & Bates, 1998); RJT (Savulich & Yiend, 2012)

3.3.6 Study Design

A cross-sectional design was used. Participants were tested across a wide range of scores on emotional trait measures. Key concerns included the correlation between participant ratings on three cognitive tasks measuring interpretation bias and their responses on emotional trait measures. First, preliminary analysis was conducted on the raw data, following the precedent in the literature (see Diagram 2). Raw scores from measures and tasks were used to determine preliminary results for each computer-based task. Second, composite scores were calculated from the raw data in order to test the hypothesis directly.

Figure 3.5 Analytical approach



Note: The self-report measures were presented to participants ahead of tasks, and they were presented in two counterbalanced, fixed order. LSAS: Liebowitz Social Anxiety Scale (Liebowitz, 1987); SIAS: Social Interaction Anxiety Scale (Mattick & Clarke, 1998); SPS: Social Phobia Scale (Mattick & Clarke, 1998); GTPS (Green et al., 2008); PS (Fenigstein & Vanable, 1992); PDI (Peters et al., 1999). SRT (based on Eysenck et al. 1991); the SST (based on Wenzlaff & Bates, 1998); the RJT (Savulich & Yiend, 2012)

To conduct the preliminary analysis, the correlation coefficients between task scores and corresponding trait scores were calculated. Hierarchical regression was performed, using each task score as a dependent variable, and its corresponding trait measure score as a predictor. Only employed measures that correlated significantly with the dependent variables were used.

To test the hypothesis, composites were calculated for social anxiety/paranoia measures and for social anxiety/paranoia related bias. Composites were generated by standardising ($M = 0$, $SD = 1$) and then calculating an average of all participant scores. Each participant thus had a composite score for social anxiety, paranoia, social anxiety related interpretation bias and paranoia related interpretation bias. Bivariate correlation and hierarchical regression analysis was then performed on the composites.

3.4 Results

3.4.1 Participant Characteristics

3.4.1.1 Data Cleaning

Preliminary analyses were conducted to ensure that assumptions of normality, linearity and homoscedasticity were not violated. In order to recruit participants with wide-ranging scores on all scales, data was not filtered. There were three missing data points; these were treated by pairwise deletion. Inspection of missing data did not suggest any systematic problems with measurement tools or methods. The missing data appeared randomly distributed.

3.4.1.2 Calculating Bias Scores

In order to compare reaction time or rating with self-report indices, bias scores were calculated for the social scenario sentences. Bias scores for each task were calculated using the equations presented in Table 3.1. We calculated two bias scores for each task: a negatively evaluated bias and a persecutory bias. Larger bias scores indicate a stronger bias towards threat interpretations over benign interpretations. The mean rating for all target items constituted the SRT interpretation bias scores in this study, as opposed to in Experiment 1, in which scores were based on the mean rating for all target social anxiety items minus the mean ratings for all target benign items .

Table 3.1 Bias score equations

Task name	Bias score	Equations	Range of values
SST	Negative bias	Interpretation Bias = (Social anxiety statements/All statements completed)*100 %	0, 100
	Persecutory bias	Interpretation Bias = (Paranoia statements/All statements completed)*100 %	0, 100
SRT	Negative bias	Interpretation Bias = Mean of ratings on all Target Social anxiety - Mean of ratings on all Target paranoia	-3, 3
	Persecutory bias	Interpretation Bias = Mean of ratings on all Target Paranoia - Mean of ratings on all Target social anxiety	-3, 3
RJT	Negative bias	Interpretation Bias = Social anxiety statements/All statements completed*100 %	0, 100
	Persecutory bias	Interpretation Bias = Paranoia statements/All statements completed*100 %	0, 100

Note: Negative bias represents social anxiety related interpretation; persecutory bias represents paranoia related interpretation

3.4.1.3 Descriptive Statistics

The emotional traits of social anxiety were operationalised as the combined average score of the three self-report measures (LSAS, SIAS and SPS), the emotional traits of paranoia as the combined average score of the three self-report measures (PS, GPTS and PDI) and interpretation bias in reaction time self-rating conditions as the combined average score of the three cognitive tasks (WSAT, SST and SRT).

Table 3.2 Means and standard deviations of trait scores and bias index scores

Social anxiety			Paranoia		
Emotional traits	Mean	SD		Mean	SD
LSAS	35.05	20.18	PS	30.28	9.57
LSAS_Anxiety	19.39	10.65	GTPS	39.91	11.33
LSAS_Avoidance	15.66	10.91	GPTS_SocialReferenc e	21.19	6.27
SIAS	20.01	13.27	GPTS_Persecution	19.15	6.07
SPS	9.96	8.26	PDI	36.65	33.41
			PDI_YesNo	5.65	9.75
			PDI_distress	9.90	9.32
			PDI_preoccupation	10.31	10.19
			PDI_conviction	13.15	12.17
Interpretation bias					
SST (%)	51.79	15.61	SST (%)	33.02	13.89
SRT	1.70	0.46	SRT	1.69	0.48
JRT (%)	70.31	11.86	JRT (%)	29.69	11.86

Note: N=80; SD=standard deviations

The means and standard deviations of all measures are presented in Table 3.2. In order to test the hypothesis that direction of interpretation bias is significantly associated with content-specific emotional traits, correlational analysis and linear regression analysis were performed. Rather than test the predictive role in each direction, regression analysis of the correlational relationship between traits and bias was performed.

3.4.2 Relationships among Putative Predictors (trait measures)

Independent variables with a bivariate correlation of greater than .70 should be excluded from multiple regression analyses (Tabachnick & Fidell, 1996). Correlation coefficients among predictor variables in this study reveal that the constructs of social anxiety (SA) and paranoia (PA) are not so highly correlated that they become indistinguishable. Most R-values are <0.8 and thus feasible to as potentially different constructs and predictors.

Table 3.3 Correlation of SA and PA

	LSAS		SIAS		SPS	
	r	p	r	p	r	p
GTPS	.52**	<.001	.40**	<.001	.66**	<.001
PS	.49**	<.001	.42**	<.001	.59**	<.001
PDI	.49**	<.001	.35**	<.001	.60**	<.001

Note: *p <0.05, **p <0.01, N= 80.

The results presented in Table 3.3 show that all R-values are <0.7. It is therefore feasible to assess social anxiety and paranoia as distinct constructs, which will then be used as independent variables to test interpretation bias.

3.4.3 Analyses Driven by the Literature

Consistent with previous work on interpretation bias, hierarchical regression was performed to assess the correlation between interpretation bias and content-specific traits in social anxiety and paranoia. The term negatively evaluated bias was used to describe the task score reflecting socially anxious interpretation styles; the term persecutory bias to describe the task score reflecting paranoia related meaning. Only significant variables from bivariate correlation analyses were entered as independent variables (trait measures). There were therefore four types of variables: social anxiety related bias (SB) and paranoia related bias (PB), social anxiety trait (ST) and paranoia trait (PT). Models for each of the two directions in interpretation bias (SB/PB) were tested using two analyses. In the first, content-matched trait scores were entered as independent variables first and converse (content-incongruent) trait scores second. For example, in explaining the SA interpretation bias, SA trait scores were entered in the first block and PA trait scores in the second. In the second analysis, converse trait scores were entered as independent variables first and content-matched trait scores second. As before, PA trait scores were entered in the first block and SA trait scores in the second. The second analysis facilitated a strength test of the trait scores in explaining content-matched interpretation bias, when controlling for the converse. This generated two Δ Adjusted R²-values. The change in Δ Adjusted R² from the first to the second analysis indicates that trait scores accounted for the additional variance in task bias scores: greater Adjusted R²-value explains the most variance in outcome interpretation bias score.

3.4.3.1 Similarity Ratings Task

The bivariate correlations of SRT and individual trait measure scores were calculated (see Table 3.4). Of the social anxiety trait measures, all scores were significantly correlated with SRT score in both the social anxiety and persecutory bias. SPS correlated most strongly with SRT in the negatively evaluated bias. Of the paranoia trait measures, all scores were significantly correlated with SRT score in both the social anxiety and persecutory bias. PS score correlated most strongly with SRT in the persecutory bias. All measures were used in the next step of analysis.

Table 3.4 Correlation of SRT and trait measures

			SRT			
			Negatively evaluated bias		Persecutory bias	
			<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>
Social anxiety measures	LSAS		0.35*	0.001	0.35*	0.001
	SIAS		0.26*	0.01	0.26*	0.01
	SPS		0.28**	0.006	0.33*	0.002
Paranoia measures	PS		0.56**	<.001	0.59**	<.001
	GTPS		0.48**	<.001	0.48**	<.001
	PDI		0.42**	<.001	0.45**	<.001

Note: **p* <0.05, ***p* <0.01. *N*= 80. Negatively evaluated bias= scores in social anxiety related meaning; persecutory bias= scores in paranoia related meaning; LSAS (Liebowitz, 1987); SIAS (Mattick & Clarke, 1998); SPS (Mattick & Clarke, 1998); GTPS (Green et al., 2008); PS (Fenigstein & Vanable, 1992); PDI (Peters et al., 1999). SRT (based on Eysenck et al. 1991)

To assess the correlation between content-specific social anxiety interpretation bias and its matched traits, hierarchical regression analyses were performed. Following Analysis 1, the negatively evaluated bias of SRT was set as the dependent variable. Social anxiety measures, including LSAS, SIAS and SPS, were entered in the first block, and all paranoia measures, including PS, GTPS and PDI, were entered in the second block. Models 1 (entering: SA measures) and 2 (entering: PA measures) were significant, and ceased to be so after adding paranoia measures. According to Model 1, 8.47% of the variance in the dependent variable could be accounted for by social anxiety measures (Adjusted $R^2 = 0.0847$, $F(3, 77) = 3.38$, $p = .02$). Thus, trait social anxiety accounted for the variance in SRT in the negatively evaluated bias. After adding the paranoia measures to the model, the change in Adjusted R^2 suggested that paranoia measures accounted for an additional 20.07% of variance in the outcome variable (Adjusted $R^2 = 0.2854$, $F(6, 77) = 6.13$, $p < .001$). The results indicate that participants who

scored higher on social anxiety and on paranoia measures tended to select the socially anxious meaning of the ambiguous SRT passage.

Following Analysis 2, PA trait scores were entered in the first block and SA trait scores in the second block. Models 3 (entering: PA trait scores) and 4 were significant. When SA trait scores were added to the model, the change in Adjusted R^2 suggested that SA trait scores accounted for less than 0.03% of the variance in the outcome variable (Adjusted $R^2 = 0.2854$, $F(3, 77) = 11.27$, $p < .001$). Δ Adjusted R^2 between Models 3 and 4 is less than that between Models 1 and 2. Thus, although both SA trait and PA trait scores explain the variance in SRT negatively evaluated bias, PA trait scores contribute more than SA trait scores to the variance in the dependent variable. The variance explained by SA trait scores was insignificant. Participants who scored higher on social anxiety and paranoia measures tended to select the socially anxious meaning of the ambiguous SRT passage. Participants who scored higher on paranoia measures rated more sentences as social anxiety in meaning than did participants who scored higher on social anxiety measures.

Table 3.5 Statistical predictors of SRT: negatively evaluated bias

		R	R ²	Adjusted R ²	Independent measures		B	Beta	t	Sig.
Analysis 1	Model 1	.3470	.1204	.0847*	ST	LSAS	.008	.33	1.71	.09
						SIAS	.003	-.06	-.3225	.74
						SPS	.005	.08	.50	.62
	Model 2	.5841	.3411	.2854**	ST	LSAS	0.003	0.13	0.70	0.49
						SIAS	0.001	0.0312	0.18	0.85
						SPS	-0.01	-0.27	-1.68	0.09
					PT	PS	0.03	0.54	2.71	0.008
						GTPS	0.002	0.05	0.28	0.78
						PDI	0.001	0.09	0.63	0.53
Adding PT increases the variance explained ($\Delta R^2 = 0.2007$) = 20.07%										
Analysis 2	Model 3	.5600	.3136	.2857**	PT	PS	0.025	0.49	2.55	0.01
						GTPS	0.001	0.04	0.21	0.84
						PDI	0.001	0.06	0.44	0.67
	Model 4	.5841	.3411	.2854**	PT	PS	0.027	0.54	2.71	0.01
						GTPS	0.002	0.22	0.28	0.78
						PDI	0.001	0.09	0.63	0.53
					ST	LSAS	0.003	0.13	0.70	0.49
						SIAS	0.001	0.03	0.19	0.85
						SPS	-0.015	-0.27	-1.68	0.10
Adding ST reduces the variance explained ($\Delta R^2 = -0.0003$) = -0.03%										

Analysis summary: when controlling for the alternative traits more variance in SB was explained by PT (20.07%) than ST (-0.03%)

Note: The dependent variable= SRT negatively evaluated bias. *p <0.05, **p <0.01. Note, N= 82. *p <0.05, **p <0.01. Negatively evaluated bias= scores in social anxiety related meaning; persecutory bias= scores in paranoia related meaning; LSAS: Liebowitz Social Anxiety Scale (Liebowitz, 1987); SIAS: Social Interaction Anxiety Scale (Mattick & Clarke, 1998); SPS: Social Phobia Scale (Mattick & Clarke, 1998); GTPS: Green et al. Paranoid Thought Scales (Green et al., 2008); PS: Self-report Paranoia Scale (Fenigstein & Venable, 1992); PDI: Peters Delusions Inventory (PDI; Peters et al., 1999). SRT: Similarity Ratings Task (SRT, Based on Eysenck et al. 1991). ST = social anxiety trait; PT paranoia trait; SB = negatively evaluated interpretation bias; PB= persecutory interpretation bias scores

The correlations between content-specific paranoia interpretation bias and its matched traits are presented in Table 3.6. Following Analysis 1, the persecutory bias of SRT was set as the dependent variable. Paranoia measures were entered in the first block; social anxiety measures in the second block. Models 1 (entering: PA measures) and 2 (entering: PA measures and SA measures) were significant. According to Model 1, paranoia measures accounted for 32.65% of the variance in the dependent variable ($\text{Adjusted } R^2 = 0.3265$, $F(3, 77) = 13.44$, $p < .001$). Trait paranoia thus accounted for the variance in the SRT reflected persecutory bias. In Model 1, the PS t -test was significant, accounting for most of the variance in the dependent variable. After adding the social anxiety measures into the model, the change in Adjusted R^2 suggested that social anxiety measures accounted for less than 1.67 % of variance in the outcome variable ($\text{Adjusted } R^2 = 0.3089$, $F(6, 77) = 6.74$, $p < .001$). As shown in Table 3.6, PS significantly accounted for the outcome variable. Therefore, although scores on both social anxiety and paranoia measures explained a significant amount of the variance in the SRT persecutory bias, the significance was decreased after adding social anxiety measures. Participants who scored higher on social anxiety and paranoia measures tended towards the paranoia interpretations.

Following Analysis 2, SA trait scores were entered in the first block and PA trait scores in the second. Models 3 (entering: SA trait scores) and 4 (entering: SA trait scores and PA trait scores) were significant. When PA trait scores were added to the model, the change in Adjusted R^2 suggested that SA trait scores accounted for an additional 20.05% of the variance in outcome variable ($\text{Adjusted } R^2 = 0.3089$, $F(6, 77) = 6.74$, $p < .0001$). The $\Delta\text{Adjusted } R^2$ between Models 3 and 4 is greater than the $\Delta\text{Adjusted } R^2$ between Models 1 and 2. Therefore, although both SA and PA trait scores explained a significant amount of the variance in the SRT negatively evaluated bias, PA trait scores contributed more than did SA trait scores to variance in the dependent variable. SA trait scores did not contribute significantly to variance in SA and PA interpretation bias on the SRT. Participants who scored higher on social anxiety and paranoia measures tended to select the paranoid meaning of the ambiguous passage. Participants with higher scores on paranoia measures interpreted more sentences as paranoid in meaning than did participants with higher scores on social anxiety measures.

Table 3.6 Statistical predictors of SRT: persecutory bias

	R	R ²	Adjusted R ²	Step	Independent measures		B	Beta	t	Sig.	
Analysis 1	Model 1	.5939	.3527	.3265**	PT	PS	0.001	0.10	0.75	0.45	
									-0.08	-0.44	0.66
						PDI	0.031	0.58	3.15	<.001	
	Model 2	.6023	.3627	.3089**	PT	PS	0.002	0.12	0.88	0.38	
						GTPS	-0.003	-0.07	GTPS	0.70	
						PDI	0.033	0.62	3.19	<.001	
					ST	LSAS	0.001	0.06	0.32	0.75	
						SIAS	0.0003	0.01	0.08	0.94	
						SPS	-0.009	-0.16	-1.03	0.31	
	Adding ST reduces the variance explained ($\Delta R^2 = -0.0167$)=-1.67%										
Analysis 2	Model 3	.3654	.1335	.0984*	ST	LSAS	0.007	0.19	0.94	0.16	
						SIAS	0.0003	-0.09	-0.49	0.63	
						SPS	-0.009	0.19	1.12	0.23	
	Model 4	.6023	.3627	.3089**	ST	LSAS	0.001	0.06	0.32	0.75	
						SIAS	0.0004	0.01	0.08	0.94	
						SPS	-0.009	-0.16	-1.03	0.31	
					PT	PS	0.033	0.62	3.19	<.001	
						GTPS	-0.003	-0.07	-0.38	0.70	
						PDI	0.002	0.12	0.88	0.38	
Adding PT increases the variance explained ($\Delta R^2 = 0.2105$) = 21.05%											
Analysis summary: when controlling for the alternative traits more variance in PB was explained by PT (21.05%) than ST(-1.67%)											

Note: The dependent variable= SRT persecutory bias. *p <0.05, **p <0.01. Note, N= 82. *p <0.05, **p <0.01. Negatively evaluated bias= scores in social anxiety related meaning; persecutory bias= scores in paranoia related meaning; LSAS: Liebowitz Social Anxiety Scale (Liebowitz, 1987); SIAS: Social Interaction Anxiety Scale (Mattick & Clarke, 1998); SPS: Social Phobia Scale (Mattick & Clarke, 1998); GTPS: Green et al. Paranoid Thought Scales (Green et al., 2008); PS: Self-report Paranoia Scale (Fenigstein & Vanable, 1992); PDI: Peters Delusions Inventory (PDI; Peters et al., 1999). SRT: Similarity Ratings Task (SRT, Based on Eysenck et al. 1991). ST = social anxiety trait; PT paranoia trait; SB = negatively evaluated interpretation bias; PB= persecutory interpretation bias scores

3.4.3.2 Scrambled Sentences Task

Bivariate correlations were examined between the scores of SST and the individual trait measures. The correlation coefficients were found in Table 3.4. Of the social anxiety trait measures, none of the social anxiety trait measures were neither significantly associated with the SST scores in negatively evaluated bias nor in persecutory bias. Of the paranoia trait measures: a significant positive correlation was found between the PDI and the SST scores in persecutory bias ($r = 0.20$, $p < 0.05$). None of the social anxiety measures significantly correlated with the SST scores in persecutory bias. Regression analysis will only be run for persecutory bias SST scores, for which only the PDI will be entered.

Table 3.7 Correlations between SST scores and trait measures

			SST (%)			
			Negatively evaluated bias		Persecutory bias	
			<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>
Social anxiety measures	LSAS		0.03	0.41	0.12	0.15
	SIAS		0.07	0.26	0.03	0.38
	SPS		-0.09	0.22	0.17	0.06
Paranoia measures	PS		-0.16	0.08	0.17	0.06
	GTPS		-0.09	0.21	0.17	0.06
	PDI		-0.10	0.19	0.20*	0.04

Note: * $p < 0.05$, ** $p < 0.01$. Note, for PS, $N = 80$. Negatively evaluated bias= scores in social anxiety related meaning; persecutory bias= scores in paranoia related meaning; LSAS (Liebowitz, 1987); SIAS (Mattick & Clarke, 1998); SPS (Mattick & Clarke, 1998); GTPS (Green et al., 2008); PS (Fenigstein & Vanable, 1992); PDI (Peters et al., 1999); SST (based on Wenzlaff & Bates, 1998)

The results indicating the correlational relationship between paranoia content-specific interpretation bias and its matched trait (the PDI) were presented in Table 3.8. The results showed that the model only reached a marginal significance. 2.67% of the variance in the dependent variable could be accounted for by the paranoia measure (PDI) (Adjusted $R^2 = 0.0267$, $F(1, 79) = 3.17$, $p = 0.079$). Thus, the PDI measured trait paranoia was marginally significantly explaining the variance in the SST reflected persecutory bias. A scatterplot summarised the regression trend of the two variables: increases in the PDI score were correlated with increases in the SST scores in persecutory bias.

Table 3.8 SST-paranoia index predictors

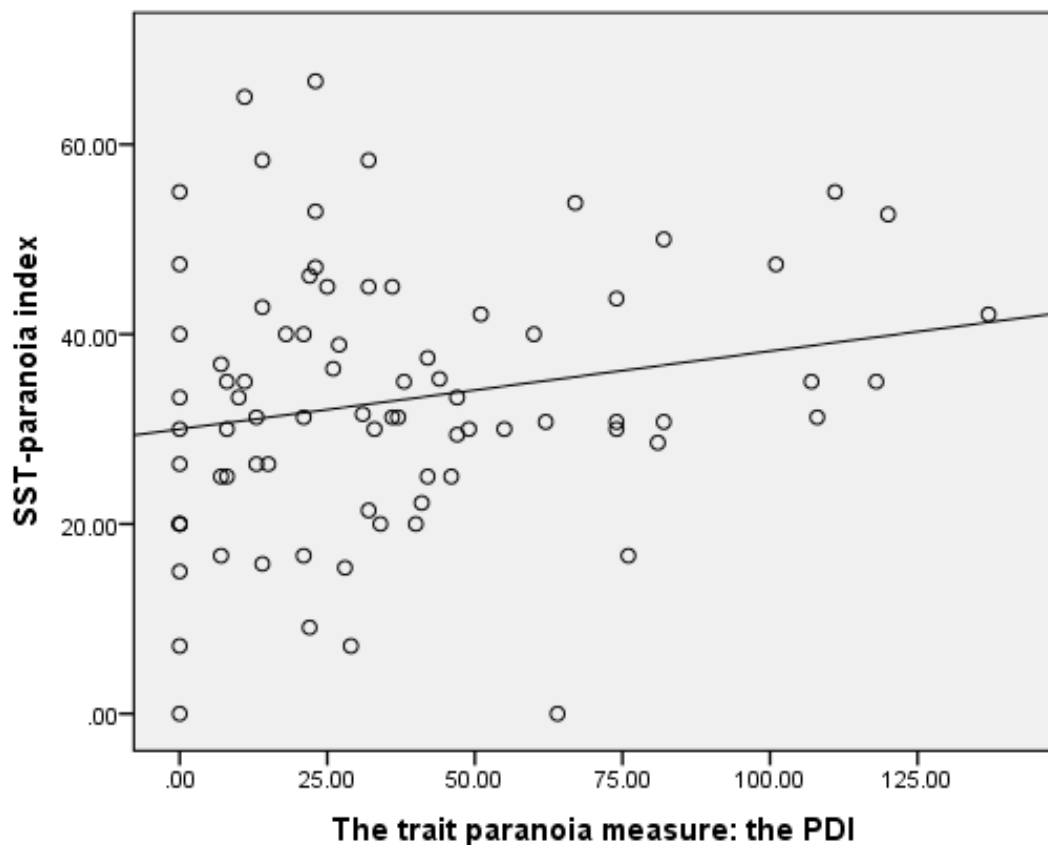
R	R ²	Adjusted R ²	Independent measures	B	Beta	t	Sig.
0.1976	0.0391	0.0267	PDI	0.08	0.19	1.78	0.07

Analysis summary: The SA bias was neither explained by SA traits nor PA traits; the PA bias was only explained by a PA trait measure (the PDI), but not by any SA trait measures.

*Note: Dependent variable = SST social anxiety index * $p < 0.05$, ** $p < 0.01$. PDI (Peters et al., 1999); SST (based on Wenzlaff & Bates, 1998)*

SST social anxiety index score was neither significantly associated with the social anxiety trait measures nor the paranoia trait measures; while the SST paranoia index score was only significantly associated with one paranoia trait measure: the PDI, but not significantly associated with any of the social anxiety trait measures.

Figure 3.6 Regression results for relationship between SST paranoia index and PDI paranoia measure



3.4.3.3 Relatedness Judgment Task

Bivariate correlations between the scores of RJT and individual trait measures were assessed (see Table 3.9). Social anxiety trait measures were not significantly correlated with either the social anxiety or the persecutory bias of the RJT. Paranoia trait measures did not correlate significantly with either the paranoia or the negatively evaluated bias of the RJT. Regression analysis was thus not performed on RJT data.

Table 3.9 Correlation between RJT and trait measures

			RJT			
			Negatively evaluated bias		Persecutory bias	
			<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>
Social anxiety measures	LSAS	LSAS	-0.05	0.32	0.05	0.32
		SIAS	0.03	0.39	-0.03	0.39
		SPS	-0.06	0.30	0.06	0.30
Paranoia measures	PS	PS	-0.09	0.21	0.09	0.21
		GTPS	0.00	0.48	0.00	0.48
		PDI	-0.13	0.14	0.13	0.14

Note: * $p < 0.05$, ** $p < 0.01$. $N = 80$. Negatively evaluated bias= scores in social anxiety related meaning; paranoia inde x= scores in paranoia related meaning; LSAS (Liebowitz, 1987); SIAS (Mattick & Clarke, 1998); SPS (Mattick & Clarke, 1998); GTPS (Green et al., 2008); PS (Fenigstein & Vanable, 1992); PDI (Peters et al., 1999); RJT (Savulich & Yiend, 2012)

3.4.4 Hypothesis-Driven Analyses

Composite scores were calculated from the raw data, as this allowed for a more direct test of the hypothesis, and they should reflect individual scores. There were therefore four composite scores representing social anxiety related bias (SB) and paranoia related bias (PB), social anxiety trait (ST) and paranoia trait (PT). The model explaining each emotional trait (ST/PT) was analysed in two ways. In Analysis 1, content-matched interpretation bias was entered as the first independent variable, and content-incongruent interpretation bias as the second. To examine ST, SB was entered in the first block; PB in the second. In Analysis 2, the converse interpretation bias was entered as the first independent variable; content-matched interpretation bias as the second. As above, PB was entered in the first block; SB in the second block. The design of Analysis 2 facilitated a strength test of content-specific bias in explaining its matched trait composite, when controlling for the converse. This generated two Δ Adjusted R^2 values. Δ Adjusted R^2 between the two analyses indicated that additional variance in the trait

composite is accounted for by one bias composite. Which Adjusted R^2 value and which direction of interpretation bias explains most variance in emotional trait?

In order to answer this question, composite scores on emotional traits and interpretation bias were generated: social anxiety trait (ST), paranoia trait (PB), social anxiety related bias (SB) and paranoia related bias (PB). We generated composites by standardising ($M = 0$, $SD = 1$) scores on each measure, and averaging these. The ST composite score was calculated by averaging the Z scores of the LSAS, SIAS and SPS. The PT composite score was calculated by averaging the PS, GTPS and PDI. The social anxiety related bias scores from the SST and the SRT were averaged to generate a composite score for social-anxiety related interpretation bias. The paranoia related bias scores from the SST and the SRT were averaged to generate a composite score for paranoia-related interpretation bias (see Table 3.1).

3.4.4.1 Bivariate Correlations between Composite Scores

The results of correlations between independent bias composites and between bias composites and dependent measures are presented in Table 3.10. The correlation coefficient for independent variables was < 0.8 . It is therefore feasible to assess the SB and PB composites as different constructs, and use both as independent variables to test interpretation bias.

Table 3.10 Correlations among composite scores

	ST		PT		SB		PB	
	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>
ST	1.00							
PT	0.62**	<.001	1.00					
SB	0.26*	0.05	0.28*	0.06	1.00			
PB	0.29*	0.02	0.46**	<.001	0.17**	0.004	1.00	

Note: PT = paranoia trait; ST = social anxiety trait; PB = paranoia bias; SB = social anxiety bias; * $p < 0.05$, ** $p < 0.01$. $N = 80$.

3.4.4.2 Hierarchical Regression

Hierarchical regression analyses were performed to determine to what extent interpretation bias predicts content-matched emotional traits. To predict social anxiety trait and following Analysis 1, the composite of interpretation bias reflecting social

anxiety meaning (SB) was entered in the first block and the composite of interpretation bias reflecting paranoia meaning (PB) in the second. The results showed that model 1 (entering: SB) and model 2 (entering: SB and PB) were both significant. Model 1 indicated that 5.31% of the variance in the dependent variable could be accounted for by SB (Adjusted $R^2 = 0.0531$, $F(1, 79) = 5.43$, $p = .02$). Thus, the SB composite significantly accounted for the variance in the ST composite. When the PB composite was added to the model, the change in Adjusted R^2 suggested that PB accounted for an additional 5.03% of variance in the outcome variable (Adjusted $R^2 = 0.1034$, $F(2, 79) = 5.56$, $p = .006$). As shown in Table 3.11, both the SB and the PB composite were significant predictors. Following Analysis 2, the PB was entered in the first block and SB in the second block. The results showed that Models 3 (entering: PB) and 4 (entering: PB and SB) were both significant. Model 3 indicated that 7.02% of the variance in the dependent variable could be accounted for by PB (Adjusted $R^2 = 0.0702$, $F(1, 79) = 6.96$, $p = .01$). When the SB composite was added to the model, the change in Adjusted R^2 suggested that SB accounted for an additional 3.32% of the variance in the outcome variable (Adjusted $R^2 = 0.1034$, $F(2, 79) = 5.56$, $p = .006$). Again, both SB and PB composites were significant predictors. Δ Adjusted R^2 between Models 1 and 2 was greater than Δ Adjusted R^2 between Models 3 and 4 (Δ Adjusted $R^2 = 0.0171$). Therefore, although both SB and PB composite explain a significant amount of variance in the ST composite, the PB composite contributed more to the variance in the dependent variable. Participants demonstrating interpretation bias in the direction of social anxiety and those demonstrating interpretation bias in the direction of paranoia were highly vulnerable to social anxiety. The latter were more vulnerable to social anxiety.

Table 3.11 Statistical predictors of SA trait composite

		R	R ²	Adjusted R ²	Independent measures	B	Beta	t	Sig.
Analysis 1	Model 1	.2551	.0651	.0531*	SB	0.35	0.25	2.33	0.02
	Model 2	.3551	.1261	.1034*	SB	0.29	0.21	1.97	0.05
					PB	0.27	0.25	2.32	0.02
Adding PB increases the variance explained ($\Delta R^2 = 0.0503$) = 5.03%									
Analysis 2	Model 3	.2863	.0820	.0702*	PB	0.32	0.29	2.64	0.01
	Model 4	.3551	.1261	.1034*	PB	0.28	0.25	2.32	0.02
					SB	0.29	0.21	1.97	0.05
Adding SB increases the variance explained ($\Delta R^2 = 0.0332$) = 3.32%									
Analysis summary: when controlling for the alternative bias more variance in ST was explained by PB (5.03%) than SB (3.32%)									

Note: Dependent variable = PT * $p < 0.05$, ** $p < 0.01$. ST = composite of social anxiety trait measures: the LSAS, SIAS and SPS; PT = composite of paranoia trait measures: PS, GTPS and PDI; SB = composite of negatively evaluated interpretation bias scores of the SST and SRT; PB = composite of persecutory interpretation bias scores of SST and SRT.

To predict paranoia trait (PT) and following Analysis 1, the PB composite was entered in the first block and the SB composite in the second. The results showed that Models 1 (entering: PB) and 2 (entering: PB and SB) were both significant. According to Model 1, 19.72% of the variance in the dependent variable could be accounted for by PB (Adjusted $R^2 = 0.0651$, $F(1, 79) = 20.40$, $p < .001$). Thus, the PB composite significantly accounted for the variance in the PT composite. As shown in Table 3.12, when the SB composite was added to the model, the change in Adjusted R^2 suggested that SB accounted for an additional 3.25% of the variance in the outcome variable (Adjusted $R^2 = 0.1261$, $F(2, 79) = 12.78$, $p < .001$). As shown in Table 3.12, both SB and PB composite were significant predictors. Following Analysis 2, SB was entered in the first block and PB in the second. The results showed that Models 3 (entering: SB) and 4 (entering: PB and SB) were both significant. According to Model 3, 6.55% of the variance in the dependent variable could be accounted for by SB (Adjusted $R^2 = 0.0655$, $F(1, 79) = 6.54$, $p = .01$). When the PB composite was added to the model, the change in Adjusted R^2 suggested that SB were accounting for an additional 16.42% of variance in the outcome variable (Adjusted $R^2 = 0.2297$, $F(2, 79) = 12.78$, $p < .001$). Again, both SA and PB composite were significant predictors. The Δ Adjusted R^2 between Models 3

and 4 is greater than the Δ Adjusted R^2 between Models 1 and 2 (Δ Adjusted $R^2 = 13.17$). Therefore, although both SB and PB composites explained a significant amount of the variance in the PT composite, the former contributed less than did SB to the variance in the dependent variable. Participants demonstrating interpretation bias in the direction of both social anxiety and paranoia were highly vulnerable to paranoia. The latter were more vulnerable to paranoia.

Table 3.12 Statistical predictors of PA trait composite

		R	R ²	Adjusted R ²	Independent measures	B	Beta	t	Sig.
Analysis 1	Model 1	.4553	.2073	.1972*	PB	0.50	0.46	4.52	<.001
	Model 2	.4992	.2492	.2297*	PB	0.47	0.42	4.19	<.001
					SB	0.29	0.21	2.07	0.04
Adding SB increases the variance explained ($\Delta R^2 = 0.325$) = 3.25%									
Analysis 2	Model 3	.2782	.0774	.0655*	SB	0.39	0.28	2.56	0.01
	Model 4	.4992	.2492	.2297*	SB	0.29	0.21	2.07	0.04
					PB	0.47	0.42	4.19	<.001
Adding PB increases the variance explained ($\Delta R^2 = 0.1642$) = 16.42%									
Analysis summary: when controlling for the alternative bias, more variance in PT was explained by PB (16.42%) than SB (3.25%)									

Note: Dependent variable = ST * $p < 0.05$, ** $p < 0.01$. ST = composite of social anxiety trait measures: LSAS, SIAS and SPS; PT = the composite of paranoia trait measures: PS, GTPS and PDI; SB = composite of negatively evaluated interpretation bias scores of SST and the SRT; PB = composite of persecutory interpretation bias scores of SST and SRT

SB and PB composites were both significantly associated with the ST composite. However, the PB composite was most weighty in the predictive model. Similarly, both the SB and PB composite were significantly associated with the PT composite, while the PB composite weighted higher in the predictive model. Thus, individuals demonstrating interpretation bias in both directions (paranoia/social anxiety) were more vulnerable to paranoia than to social anxiety.

3.5 Discussion

This study represented an extension of Experiment 1, whereby the content specificity of interpretation bias was tested directly by using a two-alternative forced choice design for

the cognitive tasks. Consistent with Experiment 1, this study addressed two related questions. First, in line with the previous literature, whether individuals with different levels of trait paranoia and social anxiety differed correspondingly in their interpretations of emotionally ambiguous information was examined. Some ambiguous information was particularly relevant to social anxiety and other ambiguous information to paranoia. Second, the key hypothesis of the thesis was examined. Experiment 1 was extended by focusing on the content-specific association of interpretation bias and its content-congruent emotional traits. Negatively evaluated (social anxiety congruent content) interpretation bias will be more strongly associated with social anxiety than will paranoia. Conversely, persecutory (paranoia congruent content) interpretation bias will be more strongly associated with paranoia than will social anxiety. Three experimental cognitive tasks reflecting the same cognitive process (interpretation of ambiguity) were analysed separately in order to address the first question; a composite score was created to address the second question. In this discussion, each question was dealt with in turn, first providing a summary of the results in tabulated form and an interpretation thereof, followed by explanations of unexpected findings and a discussion of the study limitations and implications.

3.5.1 Analyses Driven by Existing Literature

Based on previous work, we expected that individual differences in trait characteristics would be associated with corresponding differences in related interpretation bias: trait social anxiety would be more strongly associated with negatively evaluated (social anxiety congruent content) interpretation bias than would persecutory (paranoia congruent content) interpretation bias. Conversely, trait paranoia would be more strongly associated with persecutory (paranoia congruent content) interpretation bias than with negatively evaluated (social anxiety congruent content) interpretation bias.

3.5.1.1 Results summary and interpretation

Table 3.13 Key findings

Dependent variable		Results	Does the corresponding trait better explain the variance in the relating bias?
SRT	SB	When controlling for alternative traits, more variance in SB was explained by PT (2%) than by ST (-0.03%)	NO
	PB	When controlling for alternative traits, more variance in PB was explained by PT (21.05%) than by ST (1.67%)	YES
SST	SB	SB was explained by neither SA nor PT	-
	PB	PB was only explained by a PA trait measure (the PDI), but not by any SA trait measures	YES
RJT	SB	None of the SA trait measures correlated significantly with SB	-
	PB	None of the PA trait measures correlated significantly with PB	-

Note: Social anxiety content matches are shown on grey rows; paranoid matches on white rows. SB = negatively-evaluated interpretation bias; PB = persecutory interpretation bias; SA trait measures = LSAS, SIAS and SPS; PA trait measures = PS, GTPS and PDI

The key findings are presented in Table 3.13. The first question was whether individuals with different levels of trait paranoia and social anxiety differ correspondingly in their interpretations of emotionally ambiguous information. On the test of negative evaluated interpretation bias (SB), SA accounted for the variation in negative interpretations in only one of the three tasks (the SRT). SA was not a significant predictor in either of the other two tasks. On the SRT, PA contributed more than SA in the predictive model of negative interpretation bias. Negative interpretation and SA and PT were not significantly related on either the SST or the RJT, suggesting that these tasks have poor discriminant validity. Only the SRT yielded significant results for negative interpretation bias: persecutory interpretations were considered more similar in meaning to emotionally ambiguous social passages than were negative interpretations, inconsistent with the SRT results in Experiment 1.

On the test of PB, PT contributed significantly to explaining the variance on two of three tasks. Persecutory interpretations and SA and PA were not significantly associated on the RJT. The most methodologically robust measure of interpretation bias, the SRT

result, supports the original proposal, that paranoia is more strongly associated with persecutory interpretation bias than is social anxiety. This is consistent with the results of Experiment 1, and the forced choice task design of Experiment 2. In Experiment 1, when controlling for alternative traits, variance in PB was accounted for more by PT (2.41%) than by ST (0.72%). In Experiment 2, when controlling for alternative traits, variance in PB was accounted for more by PT (21.05%) than by ST (1.67%). The figure was increased by 20 times from Experiment 1 to Experiment 2, as a result of the forced choice task design. A significant association between the paranoia trait measure, PDI, and persecutory interpretation emerged on the SST. Paranoid participants unscrambled words to form more sentences in persecutory interpretation than in negative interpretation. This finding consolidated the initial hypothesis, especially in terms of the content specificity of interpretation bias, that paranoid individuals favour trait-congruent interpretation bias.

How did individual trait scores relate bias task results? SPS and SIAS scores better predicted negative (social anxiety congruent) interpretation bias. This result was, however, only marginally significant. The PDI and the PS most accurately predicted persecutory (paranoia congruent) interpretation bias.

3.5.2 Hypothesis-Driven Analyses

In answer to the key hypothesis of the thesis, content-specific interpretation bias is associated with correspondingly content-congruent interpretation bias. Negatively evaluated (social anxiety congruent content) interpretation bias is more strongly associated with trait social anxiety than is paranoia. Conversely, persecutory (paranoia congruent content) interpretation bias is more strongly associated with trait paranoia than is social anxiety.

Table 3.14 Key findings

Dependent variables	Results	Does the corresponding trait better explain the variance in the relating bias?
SA trait	When controlling for alternative traits, more variance in SA trait was explained by PB (5.03%) than by SB (3.32%)	NO
PA trait	When controlling for alternative bias, more variance in PT was explained by PB (16.42%) than by SB (3.25%)	YES

Note: Social anxiety content matches are shown in grey rows; paranoid matches in white rows. SA trait = composite of social anxiety trait measures: SADS, LSAS, SIAS and SPS; PA trait = composite of paranoia trait measures: PS, GTPS and PDI; SB = composite of negatively-evaluated interpretation bias scores on SST and SRT; PB = composite of persecutory interpretation bias scores on SST and SRT

3.5.2.1 Results Summary and Interpretations

Regression analysis of the social anxiety trait composite revealed that SB composite was significantly associated with SA trait composite. After adding the PA composite, both were significantly related to SA trait composite. This was initially interpreted as participants' being vulnerable to SA regardless of interpretation bias content. However, the negative Δ Adjusted R^2 value contributed new information to this question. After controlling for the paranoia bias composite in the relationship between social anxiety bias composite and its content congruent trait composite, both significance and Δ Adjusted R^2 were reduced.

Persecutory interpretation bias was slightly more related to trait SA than was negative interpretation bias. Although both negative and persecutory interpretation bias is associated with the vulnerability of SA, individuals who tend towards negatively-evaluated interpretations are more vulnerable to social anxiety than are those who choose persecutory interpretations. This contradicts the initial hypothesis; content specific interpretation bias in SA was not observed here.

Regression analysis of paranoia trait composite scores revealed a significant association between paranoia bias composite and paranoia trait composite. After adding the social anxiety bias composite, both SA and PB composites were significantly associated with the paranoia trait composite. Participants were thus vulnerable to

paranoia regardless of interpretation bias content. The positive Δ Adjusted R^2 value again impacted the conclusions. Controlling for social anxiety bias composite in the predictive relationship between paranoia bias composite and its content congruent trait composite increased the significance and Δ Adjusted R^2 value. This finding enhanced the association of the paranoia bias composite in the prediction of its content congruent trait composite. Participants who make persecutory interpretations are thus more vulnerable to paranoia than those who make negatively evaluated interpretations.

The second question was whether content-specific association interpretation bias is related to its content-congruent emotional trait. A close association between the social anxiety bias composite and its content-matched trait composite was observed, as well as between the paranoia bias composite and its content-matched trait composite. Analysis of the relationship between interpretation content (negatively evaluated versus persecutory) and content matched traits revealed that persecutory interpretations are highly related to vulnerability in both social anxiety and paranoia. However, persecutory interpretation bias appears more strongly associated with paranoia than with social anxiety. The content specificity of persecutory interpretation in paranoia was thus confirmed. Although negative interpretation bias is associated with vulnerability in SA, this is more weakly so than in persecutory interpretation. The role of negative interpretation content specificity in SA thus remains unclear.

The results support the initial hypothesis, that persecutory interpretation bias is more strongly associated with paranoia than with social anxiety, consistent with the results of Experiment 1. However, the negative interpretation bias results contradicted the initial hypothesis: the negatively evaluated (social anxiety congruent content) interpretation bias will be more strongly associated with social anxiety than with paranoia. When participants were forced to choose between persecutory and negative interpretations, those vulnerable to social anxiety interpreted emotionally ambiguous social scenarios as persecutory rather than negative. Although there was insufficient evidence to support the content specificity of interpretation in SA, a general interpretation bias in SA individuals was observed. This finding was also inconsistent with the results from our first experiment. As in Experiment 1, the SRT and SST were used in Experiment 2 to

test interpretation bias. However, the measures were Adjusted to test the content specificity of interpretation bias directly. In both experiments, participants were presented with similar ambiguous materials, followed by the choice of different interpretations. When given a choice between negative/positive interpretations in one set of materials and between persecutory/positive interpretations in another, SA participants in Experiment 1 preferred negative to positive interpretations and persecutory to positive interpretations. SA participants preferred negative to persecutory interpretations. However, when given a choice between negative/persecutory interpretations in same set of materials, socially anxious participants of Experiment 1 preferred persecutory to negative interpretations. SA individuals thus prefer to interpret ambiguous social information congruently with their emotional trait. However, when forced to choose between two threatening interpretations, SA individuals prefer persecutory to negative interpretations. The significant associations between trait social anxiety and negative/persecutory interpretations confirm that there is interpretation bias in SA. In one study, non-clinical paranoia was conceptualised as a type of anxious fear (So et al., 2008); indeed, a close association between SA and persecutory thoughts has been established (Mathews & MacLeod, 2002). The current results confirm that increased SA is related to more aggressive or threatening interpretation styles, consistent with the theories of processing bias, according to which, when two or more meanings compete for processing resources, individuals with high levels of trait anxiety are more likely to interpret ambiguous information as threatening (Mathews & MacLeod, 1994). In the hierarchy of paranoia (Freeman et al., 2005), severity of threatened harm escalates from SA worry (common suspiciousness) to severe harm and conspiracy. To avoid potential negative evaluations, SA individuals withdraw or restrain their behaviour at social events (Rapee & Lim, 1992; Stopa & Clark, 1993). In extreme instances, SA individuals may even translate negative evaluations into a desire to hurt the “perpetrators”, acting aggressively towards others (Kashdan & McKnight, 2010). Consistent with previous findings, the severity of interpretations increased with SA levels: the more socially anxious one is, the more severe the interpretation one generates. Compared to worries about being negatively evaluated, the results indicated that increased SA levels indicate persecutory beliefs: believing people are trying to

irritate you or cause you social or psychological harm. Alternative interpretations were limited, however, and therefore this conclusion is highly tentative.

3.5.2.2 Unexpected Finding and Possible Explanations

The association between trait SA and persecutory interpretation bias was central to the results. First, although persecutory interpretation predicting trait SA better than did negative interpretation, the Δ Adjusted R^2 value was only 1.71%. This difference was statistically real, but too small to generate a meaningful effect and potentially due to chance. Second, the discriminant validity of the amended cognitive tasks is considered. There are 22 items on the SRT. Analysis of SRT responses revealed an unexpected association between persecutory interpretation and trait SA. On six of the 22 interpretation items, sentences were not sufficiently distinct. For example, after an ambiguous passage, the sentence, "The group is gossiping about your football skill", has a persecutory meaning and the sentence, "The group thinks your previous football performance was bad", has a negative meaning. Feeling that others are gossiping about or negatively evaluating oneself constitutes threat anticipation, which indicates both SA and PA beliefs (Bentall et al., 2009). The other important groups of items were those on which meaning was interpreted as rejection. For example, "She cancelled the trip deliberately", "Your friend in the hockey team is rejecting you", "Your friends are trying to exclude you from roller boarding" and "Your friend in the Statistics lecture is deliberately snubbing you". All these sentences were developed to reflect moderate paranoid beliefs (Freeman et al., 2005). Cognitive theories and work on SA, however, suggest that beliefs about rejection are also important. Further to a fear of negative evaluation during social events, socially anxious individuals, especially those with severe conditions, are likely to assume that such evaluations would have disastrous long-term consequences for themselves, such as being rejected (Stopa & Clark, 2000). Fear of rejection is a common interpretation bias in both SA and PA. It therefore is not a distinct development stage of interpretation to distinguish social anxiety from paranoia. Increasing the severity of the persecutory items could improve the discriminant validity of the task.

3.5.3 Limitations

The results confirm a trait matched (persecutory) interpretation bias in paranoid individuals, as well as the content specificity of interpretation bias in paranoia. However, results were less conclusive for negative (SA-related) interpretation bias. Although the results confirmed an association between negative interpretations and trait SA, neither trait matched interpretation bias nor content specific interpretation bias were observed in SA. Conversely, socially anxious individuals had a slight preference for persecutory interpretations, and persecutory interpretation bias was slightly more closely related to social anxiety than was negative interpretation bias. The limitations of this study relate to these findings.

First, a few items demonstrated poor discriminant validity and are thus likely unsuitable to validate a distinction of interpretation bias between the two traits (social anxiety/paranoia). Mildly paranoid and severely socially anxious interpretations, such as feelings of being ignored, snubbed or rejected, were not sensitive enough to distinguish between the two traits. Using these stimuli to represent persecutory interpretations is misleading. Second, the picture stimulus cognitive task might not be sensitive in identifying interpretation bias. Similar to using non-semantic materials to test interpretation bias, a virtual reality experiment (Freeman et al., 2003; Freeman, 2008) presents an ambiguous social environment in a three-dimensional setting. Increases in anxiety and interpersonal sensitivity were associated with persecutory thoughts about virtual characters. The use of dimensional assessments to investigate persecutory ideation proved a valuable methodology. This might, however, be due less to the sensitivity of the task in adult participants. In one study of anxious children, social situation pictures were used to represent social interactions that could be defined as positive or negative (In-Albon et al., 2008). The results revealed a disorder-specific interpretation bias; the task triggered an emotional response and the picture paradigm demonstrated good construct validity. Although the results of this task in the current study were not significant, previous work suggests that it is worthwhile to investigate interpretation bias using a dimensional assessment rather than typical semantic materials. Finally, the cross-sectional design of the study means that the role of interpretation bias in social anxiety and paranoia cannot be concluded to be causal. The results of

Experiments 1 and 2 generated promising findings regarding the role of content specificity in paranoia. However, demonstrating the aetiological role of interpretation bias is insufficient to distinguish social anxiety and paranoia. It was useful to establish significant associations between content specific interpretations and paranoia. However, a longitudinal design is essential in order to address the causal role of interpretation bias in these traits.

3.5.4 Implications

Our experiment has theoretical implications for cognitive theory in paranoia and social anxiety. First, future research may examine the hierarchy of paranoid ideation, distinguishing paranoia from other emotional traits. According to the hierarchical structure of paranoia (Freeman et al., 2002), persecutory beliefs in paranoia range from social evaluative concerns (fears of rejection) to severe harm and conspiracy. In the current study, certain social evaluative concerns were common to social anxiety and paranoia; biased interpretation did not distinguish between the two. Including persecutory interpretation items phrased as fear of rejection enhanced the association between trait social anxiety and persecutory interpretation, compared to between trait social anxiety and negative interpretation. However, whether this was the only level in the continuous distribution that corresponded to social anxiety remains unclear. Second, in addition to the optimistic finding with dimensional assessment in persecutory interpretations, the use of picture stimuli should be applied with caution. The negative and persecutory interpretations used here did not yield valid results; further investigation is required to determine why. A longitudinal study of the causal role of interpretation bias in social anxiety and paranoia is recommended. In Experiments 1 and 2, content specificity of interpretation bias in paranoia, however, the cross sectional design was not allowed any causal conclusion of interpretation bias in its content specific emotional trait.

Our results also have practical implications for clinical interventions in paranoia and social anxiety. Mild persecutory interpretations may not necessarily indicate only trait paranoia, but also social anxiety. Patients with social evaluative concerns (e.g., fears of rejection) and ideas of reference (e.g., feelings of being talking about) may manifest both social anxiety and paranoia traits simultaneously. Approaches focus on

experiences such as persecutory thoughts rather than on diagnoses, such as social phobia or psychosis, and treats problems as existing on a continuum of severity in the population (Freeman, 2007). Based on the findings here, cognitive interventions used to treat social anxiety, when suitably modified, will likely also benefit individuals with paranoia.

3.6 Conclusions

Consistent with the literature, content specificity of interpretation bias in paranoid individuals was observed in this study. A significant association between persecutory interpretation and its content specific emotion (paranoid) trait was demonstrated. Although the findings on trait SA were less conclusive, the common mild persecutory interpretations in both traits suggest that similar cognitive intervention approaches might be applied. The forced choice design experiment generated promising findings about paranoid individuals. This line of research could be extended by investigating the causal role of interpretation in SA and paranoia, using a longitudinal design.

Chapter 4 Experiment 3 The Aetiological Role of Interpretation Bias in Social Anxiety and Paranoia

4.1 Experiment Overview

The results of the Experiment 1 suggest that interpretation bias is content specific in social anxiety and paranoia, supports were also found from Experiment 2 in paranoia. Content specific interpretation bias means being biased in the direction of one's emotional concerns, and matching one's core psychopathological trait (e.g., interpreting ambiguous social events as negative to exacerbate social anxiety; Mathews & MacLeod, 1994). Experiment 1, this finding was demonstrated in a multiple cognitive task design, and Experiment 2 confirmed findings of paranoia further in the same tasks with advanced, two-alternative choice designs. Biased interpretation is thought to be an important aetiological factor in the development and maintenance of both affective disorders (Clark & Wells, 1995) and paranoid psychosis (Freeman, Dunn, Startup & Kingdon, 2015). Specific cognitive content may precede later development of the corresponding disorder (Alford, Lester, Patel, Buchanan & Giunta, 1995). In the current study, the clinical potential of early identification of and interpretation induction in improving mood and reducing negative symptoms (Lester, Mathews, Davison, Burgess & Yiend, 2011; Yiend, Mackintosh & Mathews, 2005) has been demonstrated. In Experiment 3, we implemented a longitudinal design in a broad population in order to test the content specificity and cognitive vulnerability of biased interpretations associated with social anxiety and paranoia. Biased interpretations are tested using three cognitive experimental tasks with either socially anxious or paranoid congruent contents, as in Experiment 1. The same participants from Experiment 1 were tested six months later; all procedures were replicated. The focus was whether specific interpretation content at a time point could predict emotional traits six months later. For example, interpreting 'A stranger is standing across the street' as 'The stranger is stalking me' at one time point predicts high levels of paranoia six months later, while interpreting 'A stranger is standing across the street' as 'The stranger is laughing at me'

at one time point predicts high levels of social anxiety six months later. Hierarchical regression analyses are used to examine content-specific associations between interpretation bias and social anxiety and paranoia.

4.2 Background

Content specificity is a key component of the cognitive theory of psychopathology, according to which cognitive content is a risk factor for specific psychological disorders (Beck, Brown, Steer, Eidelson & Riskind, 1987). Activation of unique cognitive patterns thus corresponds with various clinical syndromes (Alford et al., 1995). Cognitive processes, such as the interpretations of a socially anxious individual, for example, centre on the theme of negative beliefs of being threatening evaluated by others (Foa, Franklin, Perry & Herbert, 1996). Conversely, over-concern about negative evaluation predicts social anxiety. Paranoia is characterised by the theme of persecutory beliefs: a paranoid individual tends to misinterpret their experiences as threatening, and to overestimate both the intensity and probability of anticipated harm in ambiguous situations (Freeman, Garety, Kuipers, Fowler & Bebbington, 2002). Conversely, persecutory interpretations of emotionally ambiguous information predict paranoia. Emotionally ambiguous information may result in positive or negative emotional consequences. For example, the whisper of a stranger might be experienced as praise or as disrespect, arousing in one encouragement or distress (Savulich, Freeman, Shergill & Yiend, 2015). Psychologically vulnerable individuals often make biased interpretations when dealing with such information (Beck, 1971). In interpretation bias, information is interpreted so as to favor one's pre-existing beliefs, rather than considering alternative explanations. Biased interpretations facilitate the endorsement of emotionally threatening content, reinforcing a pathological emotional trait (Beck, 1971; Murphy, Hirsch, Mathews, Smith & Clark, 2007). Those with specific interpretation biases might be at risk of developing corresponding psychological disorders (Woud, Zhang, Becker, McNally & Margraf, 2014). Interpretation bias might function as a latent vulnerability factor in the onset and maintenance of such disorders (Mathews & MacLeod, 1994).

Cognitive specificity has been demonstrated in a number of studies (Clark & Beck, 1990; Clark, Beck & Stewart, 1990; Laurent & Stark, 1993; Brown et al., 2014; Savulich et al., 2015). However, few studies have adequately evaluated whether specific cognitive content (e.g., factors theoretically related to cognitive vulnerability, such as negative interpretation and persecution) distinguish or predict later development of the corresponding disorders (Rholes et al., 1985). In a cross-sectional study, Lamberton and Oei (2008) assessed whether cognitive disturbance can distinguish anxiety from depression in 135 depressed patients. Self-report questionnaires were administered in order to assess the affective, cognitive and motivational components of anxiety and depression. The results revealed that depressive cognition is associated with and predicts depressive but not anxiety symptoms, while anxious cognition is associated with and predicts anxiety but not depressive symptoms. These findings were, however, limited because only depressed patients and self-report measures were included. The specific as opposed to the general cognitive mechanism of the disorder remained unclear from their results. Vancleef and Peters (2006) focused specifically on interpretation bias and concluded that a global and specific psychological construct is associated with content-specific negative interpretations. Trait anxiety specifically predicts a negative interpretation of panic. However, using negative interpretation as a dependent measure in regression does not elucidate the role of a negative interpretation bias in the onset and maintenance of emotional and affective disorders. Using a longitudinal design, Alford et al. (1995) tested whether negative interpretations of the future (hopeless) would be related to depressive symptoms but not to anxiety, four weeks later. They recruited 154 university students and tested them with anxiety and depression measuring them four weeks apart. A hopelessness scale was also administered at the first appointment, and a life event survey at the second. The findings were that hopelessness predicted the severity of future depression but not anxiety in male participants. Life stressors also predicted depression, but to a lesser degree than hopelessness. This result confirmed the significance of cognitive vulnerability in depression. However, we do not know whether this result can be generalised to other emotional symptoms. Creswell and O'Connor (2011) investigated the association between interpretation and anxiety in 65 children at three points in time over one year.

The results showed that different cognitive constructs related differently to anxiety; the association between threat interpretation and distress and anxiety anticipation was consistently significant. However, the study was limited by small sample size. In a large sample of 1538 women, Woud and colleagues (2014) examined biased interpretation as potential risk factor in panic disorder onset at two time points, approximately one-and-a-half years apart. An interpretation questionnaire includes ambiguous scenarios about panic- and threat-related information to test biased interpretation. The results provided strong support for the aetiological role of panic-related interpretation bias in panic disorder. Generalisability was limited, however; only women were included in the sample, and there was the potential confound of an inconsistent time interval between the baseline and follow-up test, over one-and-a-half years. In the most recent longitudinal study (Schirmbeck et al., 2016), the association between cognitive performance and obsessive-compulsive symptoms in psychotic patients and their unaffected siblings was assessed. Participants were tested at baseline and at three-year follow up. Remission of obsessive-compulsive symptoms was attributed to reduced cognitive impairment. However, the study included only two assessments during a three-year follow up period and the analysis did not account for symptom severity between assessments during the large time interval. Studies in cognitive bias modification have already established interpretation bias mechanisms as key causal factors in a variety of psychopathologies (Hoppitt, Mathews, Yiend & Mackintosh, 2010; Mackintosh, 2010a, 2010b; Lee, Mathews, Shergill & Yiend, 2015; Yiend et al., 2014; Yiend, Savulich, Coughtrey & Shafran, 2011). Few studies have assessed interpretation bias as a cognitive vulnerability factor in distinguishing different emotional symptoms, and none has extended this research to psychiatric disorders. This is an obvious next step, given that paranoia and social anxiety are highly comorbid in the prodromal stage of psychosis, and that cognitive content specificity plays a crucial role in the development and maintenance of the related emotional trait and disorders. Although a number of studies investigated the content specificity of interpretation bias in different affective disorders, very few used a longitudinal setting to test the causal role of interpretation bias in the later onset of affective symptoms.

Experiments 1 and 2 confirmed the content specificity hypothesis of interpretation bias in social anxiety and paranoia. However, their cross-sectional nature limited an aetiological interpretation of their findings. Little is known of the natural course of interpretation bias and its association with corresponding psychological traits over time. Whether specific interpretation bias may precede the development of corresponding psychological traits or even syndromes, remains inadequately investigated. The question of whether anticipation of content specific interpretation bias predicts social anxiety and paranoia remains unaddressed. The present study was designed to evaluate whether specific interpretation bias at a given point in time is significantly associated with a specific emotional trait at a later point in time. The design allows for cognitive specificity and cognitive vulnerability of interpretation bias in social anxiety and paranoia to be evaluated simultaneously. Content specificity of interpretation bias refers to bias in the direction of one's emotional concerns and consistent with one's most salient psychopathological trait. Cognitive vulnerability refers to specific interpretation bias, which precedes the development of corresponding emotional traits or syndromes. The participants from Experiment 1 were tested six months later; all procedures were replicated. A nonclinical sample was used to determine whether the corresponding interpretation biases predicted greater trait vulnerability to social anxiety and paranoid psychosis. Interpretation bias scores from three paradigms, the SRT, SST (Husstedt et al., 2002), and the Word Sentence Relatedness Paradigms (WSAP), were used to predict levels of specific matched emotional traits in a longitudinal study of a heterogeneous population tested at two time points over an approximately six-month interval. For example, interpreting 'A stranger is standing across the street' as 'The stranger is stalking me' at one time point predicts high levels of paranoia six months later, while interpreting 'A stranger is standing across the street' as 'The stranger is laughing at me' at one time point predicts high levels of social anxiety six months later. Hierarchical regression analyses are used to examine content specific associations between interpretation bias and trait social anxiety and paranoia.

The study hypotheses are stated below:

The major research interest of this project is whether specific interpretation bias improves the predictive function of one trait beyond that of another. This covers two aspects: cognitive specificity, according to which interpretation bias is associated with core psychopathological trait, and cognitive vulnerability, according to which interpretation bias is a risk factor for developing corresponding emotional traits.

- I. Negatively evaluated (social anxiety congruent content) interpretation bias predicts social anxiety more accurately than does persecutory (paranoia congruent content) interpretation bias.
- II. Conversely, persecutory (paranoia congruent content) interpretation bias predicts paranoia more accurately than does negatively evaluated (social anxiety congruent content) interpretation bias.
- III. Negative interpretation bias affects the causal role of persecutory interpretation bias in predicting paranoia.

4.3 Methods

4.3.1 Experimental Design

Participants with a wide range of scores on SA and paranoia were administered a battery of self-report personality measures and tests of interpretation bias at two time points over a six-month time interval. To measure interpretation bias for socially ambiguous information (“negative evaluation”) versus paranoia relevant information (“persecution”), three cognitive experimental tasks (SST, SRT and WSAP) were developed, each containing material reflecting both types of content.

4.3.2 Participants

84 non-clinical volunteers (59 female, 25 male) all experimental procedures at Time 1, and 71 (51 female, 20 male) completed the six-month follow up - Time 2. Participants consisted mainly of students and staff at King's College, London, and were recruited by circular email after meeting inclusion criteria for the study. The inclusion criteria were (a) being over 18 years of age, (b) fluent in English and (c) not having been diagnosed with any psychological or psychiatric disorder and not currently receiving treatment for any psychological or psychiatric disorders, including psychopharmacological medication.

The sample of 71 participants was predominantly Caucasian ($n = 48$), also including participants of Asian ($n = 9$), Black/African/Caribbean ($n = 5$) and other ($n = 9$) origin. Ages ranged from 18 to 60 years ($M = 29.82$, $SD = 12.62$). The educational attainment of participants ranged from high school ($n = 6$) to university ($n = 65$).

4.3.3 Recruitment

The Psychiatry, Nursing & Midwifery Research Ethics Subcommittee (PNM/10/11-62) approved the study. Conduct was consistent with all relevant guidance as laid out in the King's College London (KCL) Guidelines on Good Practice in Academic Research. Recruitment and the first session (the same as the previously reported in Experiment 1) of testing began in June 2011 and lasted for four months. The second session of testing started in January 2012 and lasted for four months. Participants were recruited through KCL internal circular emails and posters on local public notice boards. Volunteers were sent a study information sheet, and were identified by inviting completion of the recruitment questionnaire. This included contact details, demographic information and mood questionnaires: the SIAS (Ayessa-Arriola, et al.; Mattick & Clarke, 1998) and the self-report PS (Fenigstein & Venable). Inclusion criteria were speaking fluent English and being aged between 18 and 60 years. Exclusion criteria were currently receiving or have received treatment or counselling for mental health problems. Participants were purposively sampled to achieve wide-ranging scores on the mood questionnaires. Eligible volunteers were invited to participate in the study using the contact details provided.

4.3.4 Materials

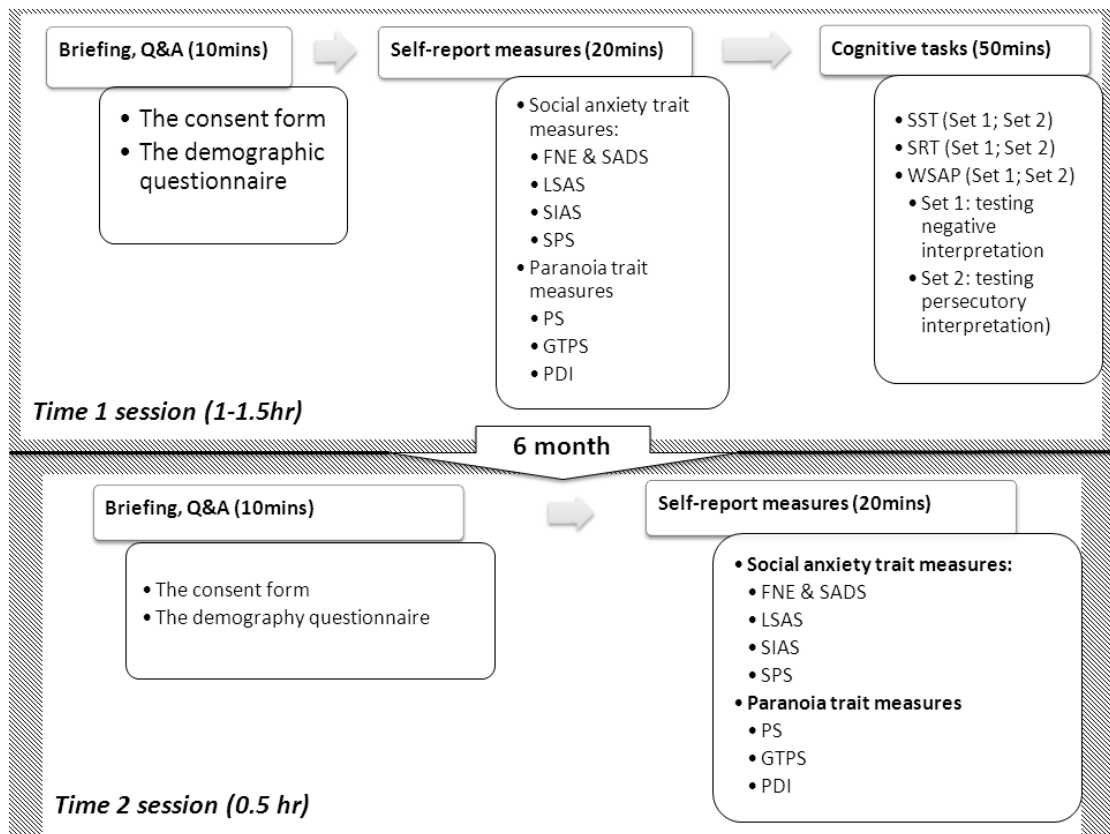
The same materials, except for the FNE, were used at Times 1 and 2, and Time 1 is the same as the previously reported in Experiment 1. The FNE was excluded, as it was not significantly correlated with any of the interpretation biases in preliminary analyses of Experiment 1. Four social anxiety measures were therefore included: the SADS (Watson & Friend, 1969), SIAS (Ayessa-Arriola et al. 1998) SPS (Mattick & Clarke, 1998) and LSAS (Liebowitz, 1987); as well as three paranoia measures: GPTS (Green et al., 2008), the self-report PS (Fenigstein & Venable, 1992) and the PDI (Peters et al., 1999), and three cognitive tasks to test interpretation bias: the SST (adapted from Wenzlaff &

Bates, 1998), SRT (adapted from Eysenck et al. 1991) and WSAP (adapted from Beard & Amir, 2010).

4.3.5 Procedure

Session 1 lasted approximately one to one-and-half-hours, varying across individuals. Session 2 lasted approximately 30 minutes. All participants were informed of the inclusion criteria before starting each session. As illustrated in Figure 4.1, in Session 1, participants were first asked to complete a consent form and demographic questionnaire, followed by self-report measures. This took approximately 20 to 30 minutes. Finally, to measure interpretation bias representing negative interpretation (social anxiety related) and persecutory interpretation (paranoia related), three cognitive experimental tasks were used, each containing two sets of material reflecting both types of content. Parallel versions of each task were developed and administered in counterbalanced order across participants. All measures were presented to participants before the interpretation tasks. Self-report measures and tasks were presented in counterbalanced, fixed random order across participants. In Session 2, participants were asked to complete a consent form, a demographic questionnaire and self-report measures. A counterbalanced design reduces the chance of order effects; that is, of other factors adversely influencing the results.

Figure 4.1 Experimental procedure

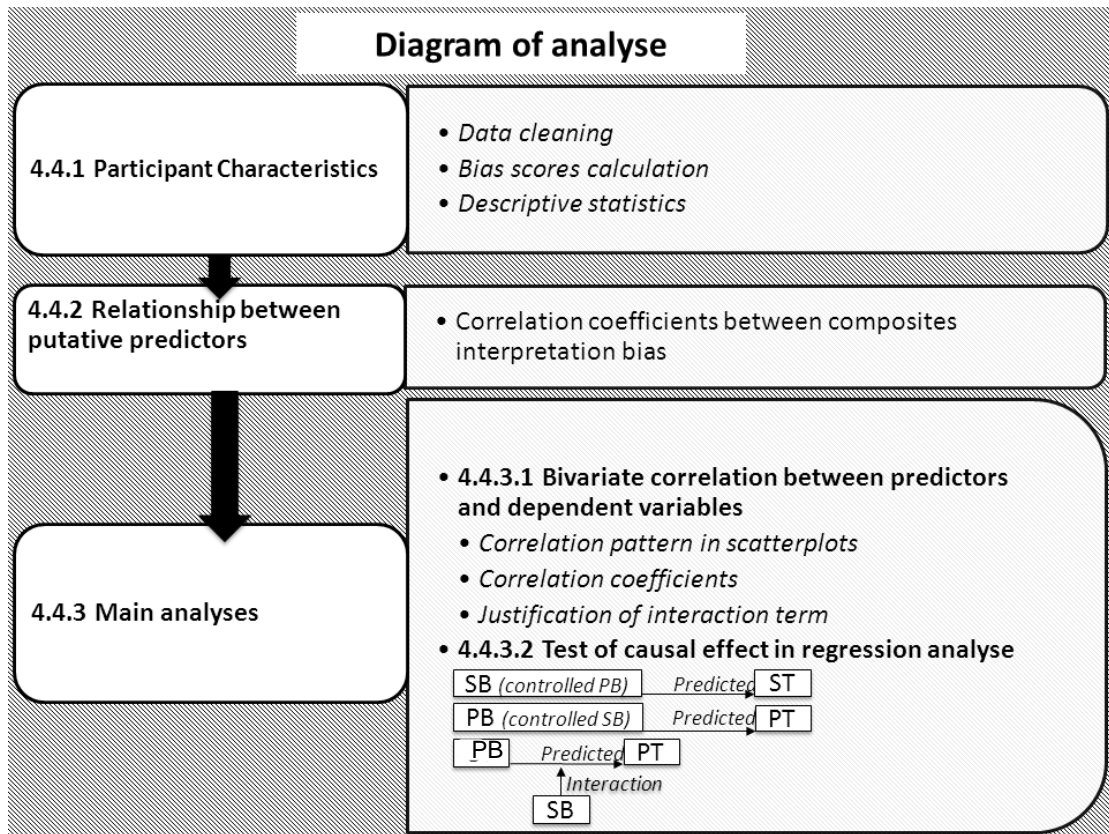


Note: Self-report measures were presented to participants ahead of tasks, in countbalanced, fixed order: LSAS (Liebowitz, 1987); SIAS (Mattick & Clarke, 1998); SPS (Mattick & Clarke, 1998); GTPS (Green et al., 2008); PS: self-report PS (Fenigstein & Venable, 1992); PDI (Peters et al., 1999). SRT (based on Eysenck et al., 1991); SST (based on Wenzlaff & Bates, 1998); WSAP (based on Beard & Amir, 2010)

4.3.6 Analysis

The focus of the analysis was to determine the predictive role of interpretation bias on emotional trait severity six months later. Composite scores were calculated from the raw data. Composite scores were considered best suited to test the hypothesis directly as well as to provide a measure of convergent validity for the construct by including several measures of the same phenomenon. Results calculated using composite scores should reflect the results achieved using individual scores.

Figure 4.2 Analytical approach



Note: Self-report measures were presented to participants ahead of tasks, in counterbalanced, fixed order. SB = negative interpretation bias represented socially anxious meaning and tested in Time 1 session; PB = persecutory interpretation bias represented paranoid meaning and tested in Time 1 session; ST = social anxiety trait tested in Time 2 session; PT = paranoia trait tested in Time 2 session

Composites were calculated for social anxiety and paranoia related bias at Time 1, and for social anxiety/paranoia measures at Time 2. Composites were calculated by standardising ($M = 0$, $SD = 1$) participant scores on each corresponding measure and task and averaging these. They represented Time 1 social anxiety related interpretation bias, and paranoia related interpretation bias, Time 2 social anxiety trait and paranoia trait. Bivariate correlation was performed on composite scores to identify any linear relationships among variables. Finally, hierarchical regression analysis was performed to test the causal effect of interpretation bias in social anxiety and paranoia.

Models for each emotional trait (ST/PT) were analysed separately (see

Figure 4.2). In Analysis 1, content matched interpretation bias was entered as an independent variable first; content incongruent interpretation bias second. For example, to explain ST, SB was entered in the first block; PB in the second. In Analysis 2, the converse applied: interpretation bias was entered as an independent variable first; content matched interpretation bias, second. Following the example above, PB was entered in the first block; SB in the second. Analysis 2 facilitated a strength test of content-specific bias in explaining its matched trait composite, when controlling for the converse. This generated two Δ Adjusted R^2 values, and the change in Δ Adjusted R^2 between the two analyses indicated that additional variance in the trait composite is accounted for significantly more by one bias composite than by the other. Which Adjusted R^2 value is greater indicated in which direction the interpretation bias explained the most variance in the outcome emotional trait.

4.4 Results

4.4.1 Participants' Characteristics

4.4.1.1 Data Cleaning

Preliminary analyses were conducted to ensure that the assumptions of normality, linearity and homoscedasticity were not violated. In order to recruit participants with wide-ranging scores on all scales, no scores were filtered from the data, except reaction time WSAP data. To reduce the influence of spurious response times, we excluded data from trials with reaction times shorter than 50ms or longer than 1500ms, following the original WSAP design (Beard & Amir, 2010). 3.28% trials were eliminated. 15 data points were missing, which were treated by pairwise deletion. The inspection of missing data did not suggest any systematic problems with measurement tools or methods, and missing data appeared randomly distributed.

4.4.1.2 Bias Scores Calculation

In order to compare reaction time or rating indices with self-report indices, bias scores for the social scenario sentences were calculated. Bias scores from each task were calculated using the equations presented in Table 4.1. We calculated two bias scores for

each task, to reflect the social anxiety and persecutory bias. Larger bias scores indicate a greater bias towards threat interpretations, and less towards benign interpretations.

Table 4.1 Bias score equations

Task name	Bias score	Equations	Range of values
SST	Negative bias	Interpretation Bias = (Social anxiety statements/All statements completed)*100 %	0, 100
	Persecutory bias	Interpretation Bias = (Paranoia statements/All statements completed)*100 %	0, 100
SRT	Negative bias	Interpretation Bias = Mean of ratings on all Target Social anxiety - Mean of ratings on all Target Benign	-3, 3
	Persecutory bias	Interpretation Bias = Mean of ratings on all Target Paranoia -Mean of ratings on all Target Benign	-3, 3
WSAP	Negative bias	Interpretation Bias = Reaction times (Social anxiety meaning reject – Social anxiety meaning endorse)	-1500, 1500
	Persecutory bias	Interpretation Bias = reaction times (Paranoia meaning reject – Paranoia meaning endorse)	-1500, 1500

Note: Negative bias represents social anxiety related interpretation; persecutory bias represents social anxiety related interpretation.

4.4.1.3 Descriptive Statistics

Means and standard deviations for each measure and task are presented in Table 4.2:

Table 4.2 Means and standard deviations of trait scores and bias scores

		Mean (SD)			
Social anxiety				Paranoia	
		Time 1 (n = 84)	Time 2 (n = 71)		
Emotional traits	FNE	12.20(4.50)	13.21(3.17)	PS	33.55(13.02)
	SADS	6.61(6.28)	6.62(7.30)	GTPS	48.60(23.28)
	LSAS	36.01(20.96)	36.14(22.38)	GPTS_Social Reference	25.35(11.53)
	LSAS_Anxiety	19.54(11.09)	20.13(11.55)	GPTS_Perse cution	23.25(12.36)
	LSAS_Avoida nce	16.75(11.08)	16.00(12.00)	PDI	52.69(42.93)
	SIAS	19.74(11.94)	19.77(12.40)	PDI_YesNo	6.23(4.35)
	SPS	11.36(11.02)	11.08(11.92)	PDI_distress	14.29(13.23)
				PDI_preoccu pation	14.46(13.42)
				PDI_convicti on	17.71(13.48)
Interpretat ion bias	SST (%)	21.87(16.50)	22.51(17.90)	SST (%)	28.08(18.03)
	SRT	1.95(0.45)	2.01 (0.60)	SRT	1.86(0.46)
	(Time 1, n=71)	-	-		-
	WSAP	27.82(115.31)	33.97(129.60)	WSAP	24.82(130.19)
					44.17(108.01)

Note: Time 1 = Time 1 session; Time 2 = Time 2 session; LSAS (Liebowitz, 1987); SIAS (Mattick & Clarke, 1998); SPS (Mattick & Clarke, 1998); GTPS (Green et al., 2008); self-report PS (Fenigstein & Venable, 1992); PDI (Peters et al., 1999); SRT (based on Eysenck et al. 1991); SST (based on Wenzlaff & Bates, 1998); WSAP (based on Beard & Amir, 2010)

To test the hypothesis that a specific kind of interpretation bias would add to the prediction of one kind of symptomatology as opposed to another, correlational analysis and linear regression analysis were performed.

4.4.2 Relationship between Putative Predictors

According to Tabachnick and Fidell (1996), independent variables with a bivariate correlation of more than 0.80 should not be included in multiple regression analysis. Correlation coefficients between raw and composite predictors in this study reveal that the constructs of negative interpretation bias (SA, representing social anxiety related meaning) and persecutory interpretation bias (PA, representing paranoia related meaning) traits were not so highly correlated as to be indistinguishable. Most *r*-values are < 0.80, making it reasonable to assess them as different constructs and thus as different predictors.

Table 4.3 Correlations between raw and composite interpretation bias scores

		Time 1 Persecutory interpretation (PA)							
		SST		SRT		WSA P		Composite (PB)	
		r	p	r	p	r	p	r	p
Time Negative interpretation (SA)	SST	0.63	<.001	0.25	0.02	0.06	0.31	0.44	<.001
	SRT	0.22	0.04	0.55	<.001	0.27	0.01	0.49	<.001
	WSAP	0.24	0.03	0.18	0.08	0.41	<.001	0.37	<.001
	Composite (SB)	0.60	<.001	0.52	<.001	0.41	<.001	0.70	<.001

Note: n=71; SA=represented social anxiety meaning; PA= represented persecutory meaning; *p <0.05, **p <0.01, N= 79. LSAS (Liebowitz, 1987); SIAS (Mattick & Clarke, 1998); SPS (Mattick & Clarke, 1998); GTPS (Green et al., 2008); PS: self-report PS (Fenigstein & Vanable, 1992); PDI (Peters et al., 1999).

From Table 4.3, it is evident that all *r*-values are < 0.80, negative and persecutory interpretation can therefore be assessed as different constructs (Baguley, 2012). Collinearity was not an issue. The constructs were to be used as independent variables to test emotional traits six months later.

4.4.3 Main Analyses

First, composites for participant scores on interpretation bias from Time 1 session and emotional traits from Time 2 session were calculated. There were therefore four composite scores representing Time 1 social anxiety related bias (SB) and Time 1 paranoia related bias (PB), Time 2 social anxiety trait (ST) and Time 2 paranoia trait (PT). The negative interpretation bias scores from Time 1 SST, SRT and WSAP were averaged to generate a composite score for social anxiety related interpretation bias. The persecutory interpretation bias scores from Time 1 SST, SRT and WSAP were averaged to generate a composite score for paranoia related interpretation bias. Composite score for the social anxiety trait was calculated by averaging the Z scores of Time 2 SADS, LSAS, SIAS and SPS. Composite score for the paranoia trait was calculated by averaging Time 2 PS, GTPS and PDI.

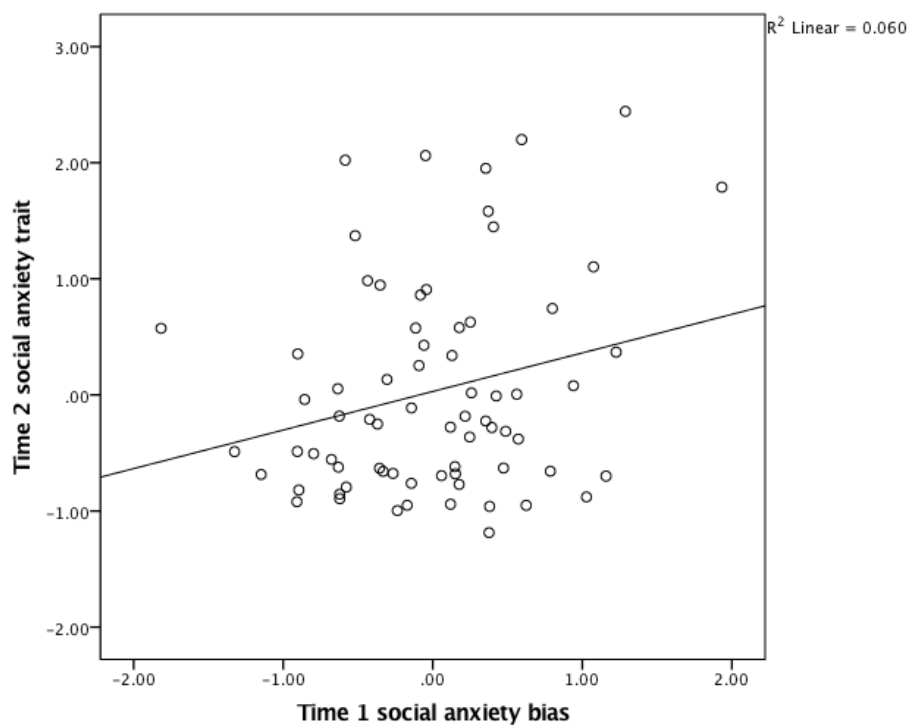
4.4.3.1 Bivariate Correlation between Predictors and Dependent Variables

Correlation patterns in scatterplots

Scatterplots were generated to check whether the relationship between variables is linear, and to identify outliers of composite scores (observations lying away from the main body of points).

Figure 4.3 illustrates the linearity of Time 1 negative interpretation (SB) and Time 2 social anxiety trait (ST).

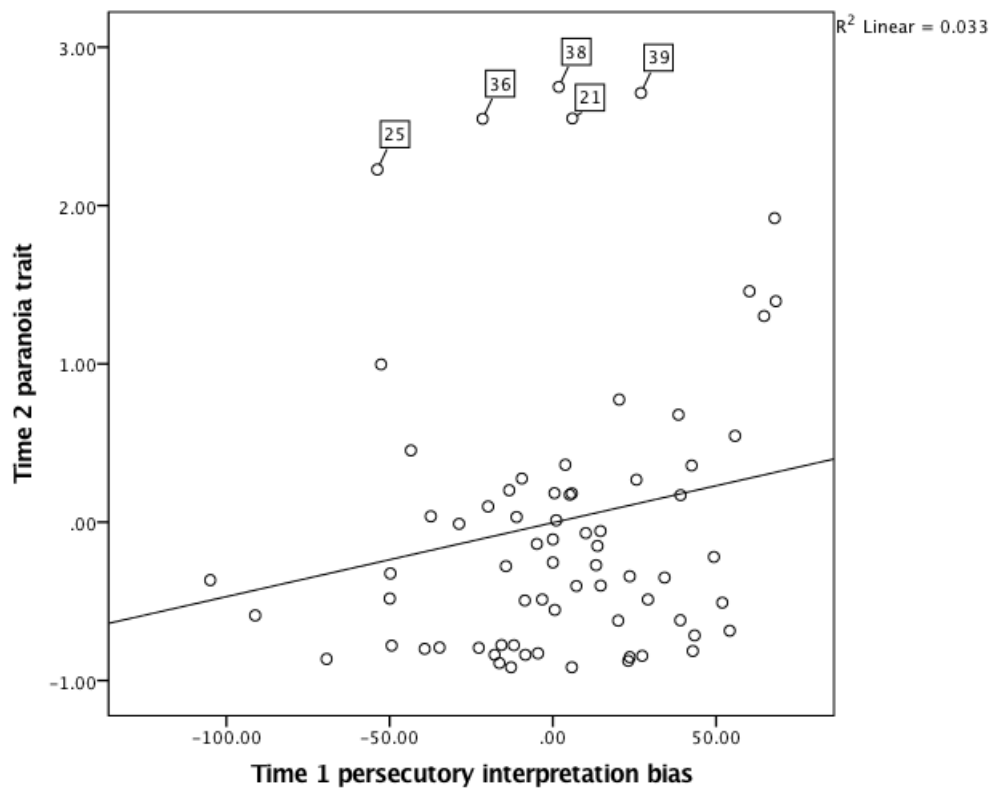
Figure 4.3 Correlation between Time 1 SB and Time 2 ST



Note: $n = 71$; Time 1 = first experiment session; Time 2 = 2nd experiment session 6 months after Time 1; negative interpretation bias represented social anxiety related meaning; persecutory interpretation bias represented paranoia related meaning.

In Figure 4.4, the moderate linearity of Time 1 persecutory interpretation bias (PB) and Time 2 paranoia trait (PT), as well as outliers (21, 25, 36, 38, 39) are illustrated.

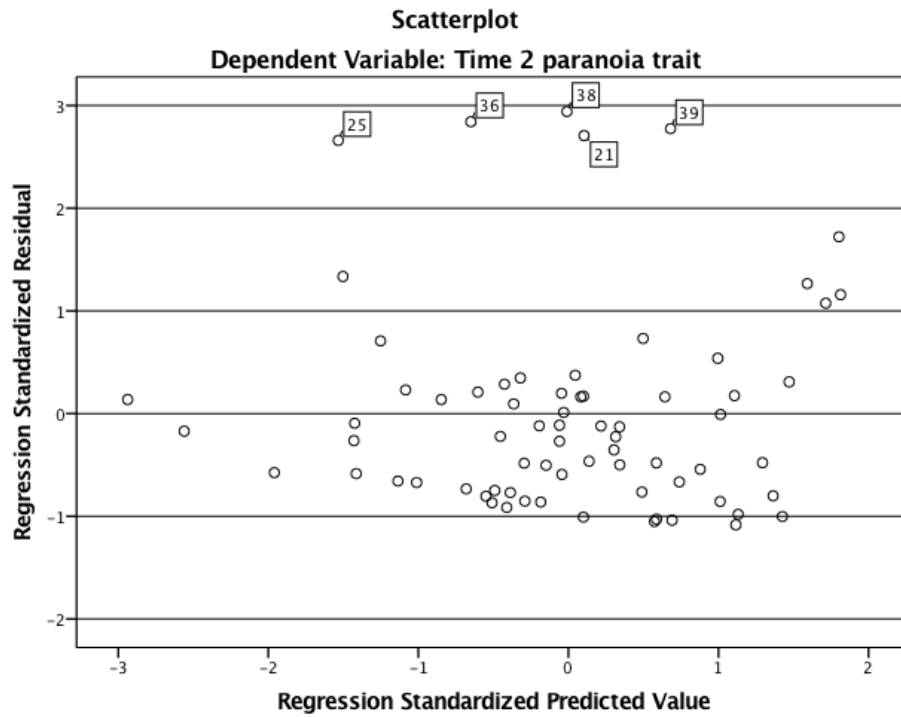
Figure 4.4: Correlation between Time 1 PB and Time 2 PT



Note: $n = 71$; Time 1 = first experiment session; Time 2 = 2nd experiment session 6 months after Time 1; negative interpretation bias represented social anxiety related meaning; persecutory interpretation bias represented paranoia related meaning.

Residual analysis was performed in order to determine whether the subjects identified above were extreme outliers, which residual against predicted values was the most common methodology for detecting outliers (Orr, Sackett & Dubois, 1991). Standardised residuals were calculated; a scatterplot of standardised residuals and regression predicted values is shown in Figure 4.5. According to Rousseeuw and Leroy (2005), a standardised residual larger than 2.5 in absolute value generally indicates an outlier, and influences regression model fit.

Figure 4.5: Standardised residuals and regression predicted values



Note: $n = 65$; the dependent variable = Time 2 paranoia trait (PT)

Regression analyses were then conducted to determine differences in model fit, with and without outliers. The results of two regression models are presented in Table 4.4:

Table 4.4 Regression models with and without outliers

	R	R ²	Adjusted R ²	p	Independent measures	B	Beta	t	F
With outliers	0.18	0.03	0.019	0.13	PB	0.005	0.18	1.53	2.33
Without outliers	0.36	0.13	0.1145**	0.003	PB	0.006	0.51	5.42	9.40

Note: $n = 65$; dependent variable = Time 2 paranoia trait (PT); PT = Time 2 composite of paranoia trait measures: PS, GTPS and PDI; Predictor = Time 1 persecutory interpretation bias; PB = Time 1 baseline composite of persecutory interpretation bias scores of the SST, SRT and WSAP

The predicted responses and significance of the hypothesis test are clearly affected by the presence of the named data point. While the data point did not affect estimated slope

coefficients, these outliers are deemed influential (Kutner, Nachtsheim & Neter, 2004), and could be removed to improve model fit.

Correlation coefficients

The results of the correlation analysis between Time 1 bias predictors and Time 2 dependent measures are presented in Table 4.5. Time 2 social anxiety trait correlates significantly with Time 1 negative interpretation bias (SB, represented socially anxious meaning) but not with Time 1 persecutory interpretation bias (PB, represented paranoid meaning). Time 2 paranoia trait was significantly correlated with both Time 1 persecutory interpretation bias (PB) and Time 1 negative interpretation bias (SB).

Table 4.5 Correlation between Time 1 interpretation bias (SB/PB) and Time 2 trait composites (ST/PT)

		Time 1			
		SB		PB	
		r	p	r	p
Time 2	ST	0.27	0.03	0.17	0.17
	PT	0.37	0.002	0.36	0.003

Note: $n = 66$; Time 1 = first experiment session; Time 2 = 2nd experiment session 6 months after Time 1; PT = paranoia trait; ST = social anxiety trait; PB = persecutory interpretation bias represents paranoid meaning; SB = negative interpretation bias represents socially anxious meaning

Interaction effect of negative interpretation

Both the experimental findings from our two previous experiments and the hierarchical structure of paranoia proposed by Freeman et al. (2005) suggest the prevalence of negative social evaluative concerns in the continuous development of paranoia. Correlation analysis of predictors showed that both Time 1 persecutory interpretation bias (PB) ($r = 0.37$, $p = 0.002$) and Time 1 negative interpretation bias (SB) ($r = 0.36$, $p = 0.003$) were significantly correlated with Time 2 paranoia trait (Table 4.5). The correlation coefficient between PB and SB was still significant after removing outliers (Table 4.3; $r = 0.46$, $p < .001$). Thus, an interaction term (SB*PB) was added into the later regression analysis (see Table 4.6) to expand the understanding of the relationship between the two predictors. The presence of a significant interaction indicates that the effect of one predictor variable on the outcome measure is different at different values of the other predictor variable. The interaction term

was calculated by multiplying the two predictors, which equaled SB*PB.

4.4.3.2 Test of Causal Effect in Regression Analysis

To test our hypotheses, we ran the hierarchical regression analyses to assess the role of specific interpretation bias in predicting its content matched emotional trait six months after baseline. In Analysis 1, the predictive value of social anxiety trait six months after baseline (ST) was analysed: baseline composite of interpretation bias reflecting social anxiety meaning (SB) was entered in the first block and baseline composite of interpretation bias reflecting paranoia meaning (PB) in the second. The interaction term (SB*PB) was added to the third block in order to assess its impact on the regression model. Only Model 1 (entering: SB) was significant. Model 1 indicated that 5.59% of the variance in the dependent variable could be accounted for by Time 1 baseline SB ($\text{Adjusted } R^2 = 0.0559$, $F(1, 64) = 4.85$, $p = 0.03$). Thus, baseline SB composite significantly explained the variance in the ST composite. When the PB composite was added to the model, the model was no longer significant. The model was not significant after adding the interaction term, SB*PB. In Analysis 2, PB was entered in the first block, SB in the second. The results showed that none of the models were significant. Therefore, only Time 1 baseline SB scores significantly explained variance in ST composite six months later, and there were no significant interaction effects between SB and PB. In sum, participants who made negative (social anxiety related) interpretations had higher scores on social anxiety measures six months later, while participants who made persecutory (paranoia related) interpretations did not.

Table 4.6 Statistical predictors of Time 2 ST composite

		R	R ²	Adjusted R ²	p	Independent measures	B	Beta	t	Sig.
Analysis 1	Model 1	0.27	0.07	0.0559*	0.039	SB	0.35	0.27	2.20	0.03
	Model 2	0.27	0.07	0.0441	0.121	SB	0.31	0.24	1.73	0.09
						PB	<.001	0.06	0.46	0.65
	Interaction	0.33	0.11	0.628	0.07	SB*PB	0.01	0.20	1.50	0.14
The model was only significant when SB alone were entered										
Analysis 2	Model 3	0.17	0.03	0.0141	0.17	PB	.004	.003	0.14	0.17
	Model 4	0.27	0.07	0.0441	0.09	PB	.001	.003	0.46	0.65
						SB	0.31	0.18	1.74	0.09
None of the two models were significant										
Analysis summary: ST was only explained by baseline SB at 5.59%										

Note: n = 65; dependent variable = Time 2 social anxiety trait (ST); ST = Time 2 composite of social anxiety trait measures: SADS, LSAS, SIAS, and SPS; PT = Time 2 composite of paranoia trait measures: PS, GTPS and the PDI; SB = Time 1 baseline composite of negatively evaluated interpretation bias scores of the SST, SRT and WSAP; PB = Time 1 baseline composite of persecutory interpretation bias scores of the SST, SRT and WSAP.

In Analysis 1, to predict paranoia traits (PT), Time 1 baseline composite of interpretation bias reflecting paranoia meaning (PB) was entered in the first block, and composite of interpretation bias reflecting social anxiety meaning (SB) in the second. The interaction term (SB*PB) was added to the third block to assess its impact on the regression model. Both Models 1 (entering: PB) and 2 (entering: SB) were significant. "In Model 1, 11.45% of the variance in the dependent variable was accounted for by PB (Adjusted R² = 0.1145, F(1, 64) = 9.40, p = .003). Thus, PB composite significantly explained the variance in the PT composite. As shown in Table 4.7, when the SB composite was added to Model 2, the change in Adjusted R² suggested that SB accounted for an additional 3.91% of the variance in the outcome variable (Adjusted R² = 0.1536, F(2, 63) = 6.89, p = 0.002). Both PB and SB composite reached marginal significance as independent predictors. The interaction term SB*PB was added to the model as the last step. As seen in Table 4.7, the model was significant after adding the interaction term SB*PB, and the variance increased by 13.78% (Adjusted R² = 0.2914, F(3, 62) = 9.91, p < 0.001). Both PB and interaction term SB*PB were emerged as significant predictors, which interaction term SB*PB are more weighted than

PB.” In Analysis 2, SB was entered in the first block, and PB in the second. Models 3 (entering: SB) and 4 (entering: SB and PB) were both significant. In Model 3, 12.02% of the variance in the dependent variable could be accounted for by the SB (Adjusted $R^2 = 0.1202$, $F(1, 64) = 9.88$, $p = 0.003$). When the PB composite was added to the model, the change in Adjusted R^2 suggested that PB accounted for an additional 3.34% of variance in the outcome variable (Adjusted $R^2 = 0.1536$, $F(2, 63) = 2.42$, $p < .002$). Both SB and PB composite reached marginal significance as predictors. Δ Adjusted R^2 from Model 3 to 4 was less than Δ Adjusted R^2 from Model 1 to 2 at Δ Adjusted $R^2 = -0.0056$. Therefore, both SB and PB composite explained a significant amount of the variance in PT. SB composite contributed more than PB composite to variance in the dependent variable. There were also significant interaction effects between SB and PB when predicting PT. Thus, the effect of PB differs depending on the level of SB in predicting paranoia (PT). In sum, participants who tended towards persecutory interpretation bias were highly vulnerable to paranoia six months later. This vulnerability depends significantly on the presence of negative interpretation bias.

Table 4.7 Statistical predictors of the Time 2 PT composite

		R	R ²	Adjusted R ²	p	Indepe ndent measur es	B	Beta	t	Sig.
Analy sis 1	Model 1	0.36	0.13	0.1145*	0.003	PB	0.006	0.51	5.42	0.003 *
	Model 2	0.42	0.18	0.1536*	0.002	PB	0.004	0.32	2.5	0.07
						SB	0.25	0.29	2.29	0.05
	Interacti on model	0.57	0.32	0.2914**	<.001	PB	0.005	0.27	2.28	0.03
						SB SAbia* PB	0.07 0.01 0.42	0.07 0.42 3.64	0.54 3.64 3.64	0.59 0.001 0.001
Adding SB increases the variance explained ($\Delta R^2= 0.0391$)=3.91%; Adding SB*PB increases the variance explained ($\Delta R^2= 0.1378$)=13.78%										
Analy sis 2	Model 3	0.37	0.13	0.1202**	0.003	SB	0.37	0.37	3.14	0.003 *
	Model 4	0.42	0.18	0.1536**	0.002	SB	0.26	0.26	1.99	0.05
						PB	0.004	0.24	1.88	0.07
Adding PB increases the variance explained ($\Delta R^2= 0.0334$)=3.34%										
Analysis summary: similar variance in PT was explained by SB (3.91%) and PB (3.34 %); adding SB*PB increases the variance explained at the most ($\Delta R^2= 0.1378$)=13.78%										

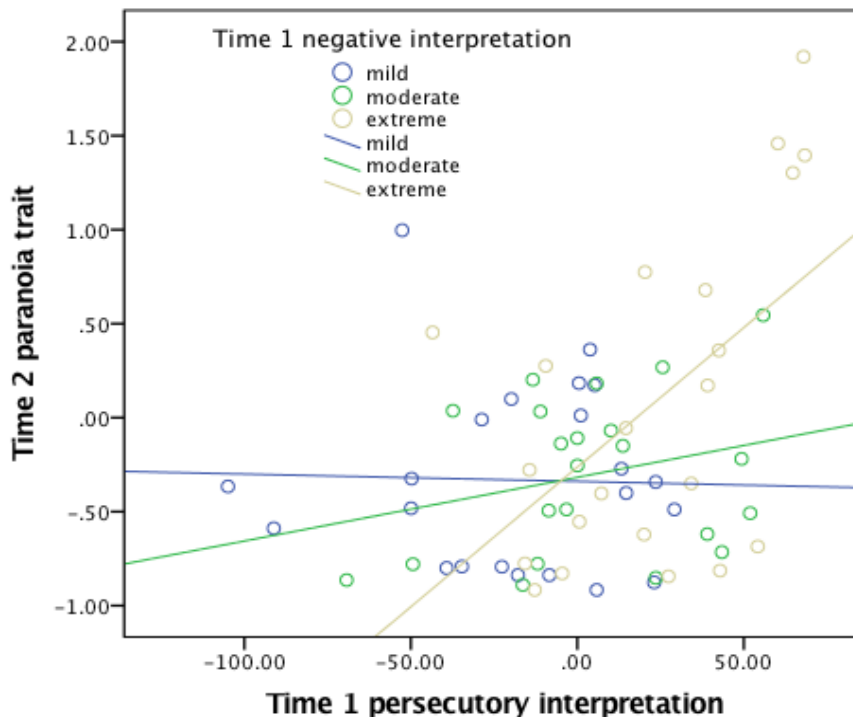
Note: n = 65; The dependent variable = Time 2 social anxiety trait (ST); ST = Time 2 composite of social anxiety trait measures: SADS, LSAS, SIAS and SPS; PT = Time 2 composite of paranoia trait measures: PS, GTPS and PDI; SB = Time 1 baseline composite of negatively evaluated interpretation bias scores of the SST, SRT and WSAP; PB = Time 1 baseline composite of persecutory interpretation bias scores of the SST, SRT and WSAP.

Only SB predicted ST six months later, and there was no significant interaction effect between SB and PB when predicting ST. By contrast, both SB and PB predicted PT six months later, while SB was more significant than PB in the prediction model. There was a significant interaction effect between the two predictors in predicted PT. The more likely participants were to make negative interpretations, the more likely they were to have elevated social anxiety six months later. Levels of paranoia bias, however, did not significantly impact later levels of social anxiety. By contrast, participants who made negative and those who made persecutory interpretations were vulnerable to paranoia six months later. Negative interpretation bias showed significant interaction effects when persecutory interpretation bias predicted paranoia trait.

Interaction effects of negative interpretation bias

Additional analysis was conducted owing to the significant interaction effects of negative interpretation and persecutory interpretation bias in predicting the paranoia trait. As shown in Table 4.7, adding the interaction term, SB*PB, increased the variance by 13.78%. SB*PB accounted for more in the prediction model (Adjusted $R^2 = 0.2914$, $p < 0.001$, $\beta = 0.01$) than did PB ($\beta = 0.005$) but for less than did SB ($\beta = 0.07$). PB affected the outcome measure differently at different SB values. As shown in Figure 4.6, each point in the interaction plot ($n = 66$) showed mean paranoia trait composite at combinations of predictor levels. The unparallelled lines indicated an interaction between the two predictors (SB/PB).

Figure 4.6: Regression analysis of persecutory interpretation on paranoia trait when set by different severity of negative interpretation groups ($n = 66$)



Note: $n = 66$; Time 1 = first experiment session; Time 2 = 2nd experiment session six months after Time 1; negative interpretation bias represented social anxiety related meaning; persecutory interpretation bias represented paranoia related meaning. Mild = participants made mild degree of negative interpretation; moderate = participants made moderate degree of negative interpretation; extreme = participants made extreme degree of negative interpretation.

As illustrated in Figure 4.6, persecutory interpretation exerted a significant impact on the paranoia trait when participants made extremely negative interpretations. Persecutory interpretation exerted less impact on the paranoia trait when participants made moderately or mildly negative interpretations.

4.5 Discussion

In this study, the cognitive specificity and cognitive vulnerability of interpretation bias in social anxiety and paranoia were investigated simultaneously. Content specificity of interpretation bias refers to biases that tend in the direction of one's emotional concerns and that match one's core psychopathological trait. Cognitive vulnerability refers to specific kinds of interpretation biases preceding the development of corresponding emotional traits, or even of syndromes. In this study, whether type of interpretation bias is significantly associated with its corresponding emotional trait, was examined. Negatively evaluated (social anxiety congruent content) interpretation bias predicted persecutory interpretation bias better than did social anxiety. Conversely, persecutory (paranoia congruent content) interpretation bias predicted paranoia better than did negatively evaluated (social anxiety congruent content) interpretation bias. Three experimental cognitive tasks reflecting the same cognitive process (interpretation of ambiguity) were analysed by creating a composite score. In the following discussion, these findings are explored and interpreted, unexpected findings explained and the implications and limitations of the study discussed.

4.5.1 Results Summary

The main hypothesis of the thesis is that specific interpretation bias at a given time predicts corresponding emotional trait severity at a later time point. Negatively evaluated (social anxiety congruent content) interpretation bias predicted social anxiety better than did persecutory interpretation bias. Conversely, persecutory (paranoia congruent content) interpretation bias predicted paranoia better than did negatively evaluated (social anxiety congruent content) interpretation bias.

Table 4.8 Key findings

Dependent variables	Results	Does the corresponding bias better explain the variance in the related (i.e. content matched) traits?
Time 2 ST	ST was only explained by baseline SB at 5.59%	YES
Time 2 PT	When controlling for the alternative bias, similar variance in PT was explained by SB (3.91%) and PB (3.34 %)	NO
Interaction	Adding SB*PB increases the variance explained at the most ($\Delta R^2 = 0.0378$) = 13.78%	

Note: Social anxiety content matches are shown on grey rows, and paranoid ones are shown on white rows. Fenigstein PS ST = composite of social anxiety trait measures: SADS, LSAS, SIAS and SPS; PT = the composite of paranoia trait measures: PS, GTPS and PDI; SB = the composite of negatively evaluated interpretation bias scores of the SST, SRT and WSAP; PB = composite of persecutory interpretation bias scores of the SST, SRT and WSAP

4.5.2 Results Interpretation

A summary of the key findings is presented in Table 4.8. Only negative evaluated interpretation bias (SB) explained the variance in social anxiety trait (ST), and PB contributed nothing to the model. Only the negative interpretation bias (representing social anxiety related meaning) composite significantly predicted social anxiety six months later; persecutory interpretation bias did not. Persecutory interpretation bias did not impact in the relationship between negative interpretation and paranoia. This suggests that individuals who tended towards negative interpretation biases were likely to suffer from social anxiety six months later, while participants who tended towards persecutory interpretation bias were not. This result was unaffected by persecutory interpretation bias.

Both persecutory interpretation bias (PB) and negative evaluated interpretation bias (SB) explained an almost equal amount of variance in the paranoia trait (PT). When controlling for alternative bias, SB (3.91%) and PB (3.34 %) explained a similar amount of the variance in PT. Both persecutory and negative evaluated interpretation bias thus predicted paranoia six months later. This suggests that both individuals making negative and those making persecutory interpretations were likely to suffer from paranoia.

In addition to the above finding, there was a significant interaction effect of negative interpretation bias and persecutory interpretation bias in predicting paranoia. In order to

investigate the interaction effects further, we categorised negative interpretation bias into three magnitudes: mild, moderate and extreme negativity. The results showed that its interaction effects were different in degree and direction. The most significant impact of persecutory interpretation on paranoia trait emerged when participants made extremely negative interpretations. The effect of persecutory interpretation bias is especially pronounced when participants also demonstrate a strong negative interpretation bias: individuals who make persecutory interpretations were more likely to develop paranoia if they also made extremely negative interpretations, while individuals who made only moderately or mildly negative interpretations were less likely to do so. Individuals who explained social ambiguity with persecutory intention (e.g., "People harm me") were thus likely to suffer from paranoia six months later, and this chance was increased if they also made moderate (e.g., "People criticise me") or extremely negative interpretations (e.g., "People hate me").

Overall, the results partially support the hypothesis that cognitive specificity and cognitive vulnerability significantly predict social anxiety and paranoia. The test of cognitive specificity revealed that only negative interpretation bias (content matched) is associated with social anxiety trait after six months, while persecutory interpretation bias is not, supporting the content specificity hypothesis. Both negative and persecutory interpretation bias is associated with the paranoia trait after six months. The test of cognitive vulnerability revealed that individuals who made the most extreme negative interpretation bias were most likely to suffer from social anxiety six months later, while participants with persecutory interpretation bias were not. Meanwhile, both individuals who made negative and persecutory interpretations were likely to suffer from paranoia. In addition, the severity of paranoia, predicted by persecutory interpretation bias, depended upon the magnitude of negative interpretation bias. The effect of persecutory interpretation bias is especially pronounced when participants also demonstrate moderate to extreme negative interpretation bias.

The results clearly support cognitive theories in social anxiety (Clark & Wells, 1995; Hirsch & Clark, 2004; Morrison & Heimberg, 2013) in a subclinical population, especially in terms of aetiologically: negatively biased information processing contributes to the development of

social anxiety. The results are consistent with cognitive theories of psychopathology in emotional disorders, that each emotional trait is characterised by a cognitive bias, content specific to that trait (Beck et al., 1991; Williams, Watts, MacLeod & Mathews, 1988). By identifying the content of current interpretation biases, future emotional vulnerability can be predicted. Few studies have been conducted to distinguish depression from anxiety (Alford et al., 1995), panic from general anxiety (Vancleef & Peters, 2008; Woud et al., 2014) and anxiety from depression (Baldwin, Evans, Hirschfeld & Kasper, 2002; Cannon & Weems, 2010). The current findings extend previous research on distinguishing social anxiety from paranoia. We demonstrated the causal understanding of interpretation bias by comparing the content of interpretation bias (representing socially anxious/paranoid meanings) and its predictive role in social anxiety and paranoia. The more one cares about the negative evaluations of others, the more they are in danger of suffering social anxiety in the future. The persecutory content of one's interpretations was, however, irrelevant. The finding that the severity of paranoia depended upon the magnitude of the negative interpretation bias is consistent with dimensional views of negative interpretation in emotional disorders (e.g., Lee et al., 2016; Baert, De Raedt & Koster, 2010). For instance, the degree of negative interpretive bias is closely related to depression severity and the magnitude of negative interpretive bias varies systematically according to the severity of depression (Lee et al., 2016). Here, these findings extend to other emotional disorders, including social anxiety and paranoia.

4.5.3 Unexpected Finding and Possible Explanations

Although the social anxiety findings confirmed the study hypotheses, the findings related to paranoia were more complex. Both individuals who tended towards negative and those who tended towards persecutory interpretation were likely to suffer from paranoia, while the severity of paranoia predicted by persecutory interpretation bias depended upon the magnitude of negative interpretation bias. The cognitive vulnerability results of Experiment 3 in paranoia suggest a causal role for persecutory interpretation in the development of paranoia. In terms of cognitive specificity and paranoia, persecutory and negative evaluated interpretation bias both played a significant role in the development of paranoia. Furthermore, these variables interacted in the prediction of paranoia, so that the extent to

which persecutory interpretation predicted the severity of paranoia depended upon the magnitude of negative interpretation bias. Persecutory interpretation bias is especially pronounced when participants also demonstrate a moderate to extremely negative interpretation bias.

Although the role of negative evaluative interpretations in predicting paranoia did not directly supported the cognitive specificity hypothesis, it was consistent with what has been proposed by many other cognitive theorists of psychosis in the past (McReynolds, 1960; Garety & Freeman, 1999). Freeman et al. (2005) suggested a hierarchical structure of paranoia, according to which the distribution of paranoid beliefs in the general population is continuous, including social evaluative concerns (e.g., rejection, ignorance), ideas of reference (e.g., judgement, criticism), mild threat (e.g., irritation), moderate threat (e.g., stalk) and severe threat (e.g., conspiracy, harm). The less plausible paranoid interpretation (on top hierarchy, e.g., people try to cause harm on me) builds upon commoner, more plausible ones (on bottom hierarchy, e.g., people ignore/ criticise me) (D. Freeman, Garety, Bebbington, Slater, et al., 2005). Anticipation of rejection, a mildly paranoid (Freeman et al., 2005) yet catastrophic socially anxious interpretation (Stopa & Clark, 2000), was a prominent theme common to paranoia and social anxiety. Socially anxious individuals characterise themselves in enduringly negative ways (e.g., People think I was boring). This may be catastrophic for them, posing disastrous long-term consequences (e.g., People will reject me, I will lose all my friends). Anxiety related beliefs play an important a role in the formation and maintenance of persecutory beliefs (Garety & Freeman, 1999). Arguably, it is not the content of the interpretations that distinguish individuals with persecutory delusions from the general population, but the degree of general worry and anxiety, and the degree to which they can control these thoughts (Peters, Joseph & Garety, 2004). When anxiety deepens, persecutory interpretations or delusions may develop, in an attempt to stabilise and assimilate unprocessed information, reducing anxiety (Freeman, Garety & Phillips, 2000). The findings here support the above theory, that the severity of paranoia predicted by persecutory interpretation bias depends upon the degree of negative interpretation bias. Persecutory interpretation bias had the greatest causal impact on paranoia, and related negative interpretation bias was to a catastrophic degree.

4.5.4 Limitations

According to these findings, negative evaluative interpretation bias plays a causal role in social anxiety, and persecutory and negative interpretation bias in paranoia. However, the results on the content specificity and prediction of each emotional trait were complex. Although negative interpretation bias alone contributed to the severity of social anxiety, it interacted significantly with persecutory interpretation bias in predicting the severity of paranoia. This result is consistent with the hierarchical structure of paranoia (Freeman et al., 2005): that the distribution of paranoia beliefs in the general population is continuous and includes social evaluative concerns. First, the small sample size of this study ($n = 71$) limited its power. Conclusions about the significant impact of negative interpretation in the prediction model must thus be drawn cautiously. The results need to be replicated with a larger sample and in a clinical population. For example, a recent study of attention bias demonstrates a pattern of bias opposite to that observed using similar methods in subclinical samples to date (Yiend et al., 2015). Second, removing outliers before the main analysis could be critical. One may argue that this has been a more optimal approach, and would have strengthened the conclusions here. Five subjects were removed as outliers. Although this step was statistically justifiable, how best to deal with outliers has always been debated. One might argue that outliers are legitimate data points that represent valuable information about the variables, and that data are more likely to be representative of the population if outliers are not removed (Orr, Sackett & DuBois, 1991). However, the presence of outliers may result in inflated error rates and substantial distortions of parameter and statistic estimates (Zimmerman, 1998). Removing outliers enhances the accuracy of the overwhelming majority of analyses, significantly reducing errors of inference in most cases (Osborne & Overbay, 2004). Third, maintaining a constant time interval between Times 1 and 2 was impossible. Therefore, the six months does not represent an exact planned interval, and we do not know whether this affected the results. However, we only allowed for one week before or after the priori tested date to minimise unexpected effects. Fourth, our design included two experimental sessions and changes in participant trajectories could not be examined. Hence, a life event questionnaire would have been added at the follow-up session to monitor the effect of major life incidents on the data. Lastly, participants were not drawn from a clinical

population. The changes of emotional traits and biases scores in a non-clinical sample may be limited. The non-clinical sample was naturally assumed as a psychologically stable sample, namely the concerned factors of this study would not significantly fluctuate in this population. However, we firstly used a longitudinal design to maximum the chance to observe any changes of this data; secondly, we screened the participants, and tested a wide range of population, which allowed observations of natural trends of relationship between the concerned variables; lastly, any results of changes observed from non-clinical sample would be easier to interpret and generalize. Because this sample are most closet to the population that was treated in normal life. Furthermore, the continuity of non-clinical and clinical mechanisms is suggested by Beck's (1984) cognitive model of psychopathology. Therefore, generalising the findings from non-clinical population to a clinical population is not unreasonable, as a clinical population already would have significant symptoms. However, group comparison analyses should be added in order to demonstrate the interpretation bias in the two clinical groups

4.5.5 Implications

Our experiment has theoretical implications for the aetiology of paranoia and social anxiety. First, our data confirmed the content specific causal effect of negative evaluative interpretation bias in developing social anxiety, consistent with major cognitive theories of social anxiety (Clark & Wells, 1995; Rapee & Heimberg, 1997; Hirsch & Clark, 2004; Morrison & Heimberg, 2013), as well as with the cognitive specificity of psychopathology in emotional disorders (Beck et al. 1976; Williams et al., 1988; Eysenck et al., 1991). Moreover, the data provides new insights into how paranoia develops. This becomes even more important when considering that the literature on paranoia does not provide many demonstrations of the predictive power of interpretation bias. Although the evidence here is restricted to the subclinical population, it is anticipated that the findings might generalise to a clinical population. Persecutory and negative evaluative interpretation bias should be considered causal risk factors at a clinical level, potentially even predictive of new onset of psychotic symptoms. Second, the findings here confirm that paranoia is hierarchical in structure (Freeman et al., 2005). Paranoia develops from paranoid beliefs that range from mild, socially evaluative concerns to severe, persecutory concerns. The results suggest the

accuracy with which persecutory interpretation bias predicts the severity of paranoia depends upon the degree of negative interpretation bias. Persecutory interpretation bias has the greatest causal impact on paranoia; when combined with negative interpretation bias, paranoia was most catastrophic. Thus, beyond the initial hypothesis about the content specificity of interpretation bias in paranoia, the degree of interpretation bias was also a dimension that should be considered in the development of paranoia. Lastly, the data also suggests a range of negative interpretative bias tasks that might be useful in such research, including semantic and situational contexts, self-report and and reaction time measures.

The results are also of empirical importance for clinical interventions in paranoia and social anxiety. First, our findings have important implications for the selection of intervention targets in newer methods, such as cognitive bias modification or existing cognitive therapy. Based on the results, negative evaluative interpretation bias is the proposed target for social anxiety intervention, while both negatively evaluative and persecutory interpretation bias are the targets for paranoia intervention. Second, the linear association between interpretation bias and the severity of social anxiety and paranoia suggest that interpretation bias is not only a corollary of the traits, but might also be a vulnerability factor in the subsequent development of such emotional traits. Further studies should attempt to evaluate prospective cognitive vulnerability, together with purely symptom/trait measurement. Third, the significant interaction effects between negatively evaluative and persecutory interpretation bias suggest the possibility of applying a cognitive model of social anxiety to paranoia. If social anxiety related interpretation bias plays a role in paranoia symptoms, then established cognitive-behavioural anxiety-reduction techniques might reduce paranoia symptoms. Cognitive-behavioural therapy (CBT) was suggested by the National Institute for Health and Clinical Excellence (NICE) in the clinical guidelines for all schizophrenic patients, which may be applied during either the acute phase (Phase 2) or later, including in inpatient settings. A review of 20 randomised controlled trial studies (Tarrier & Wykes, 2004) that used CBT for psychosis (CBTp) to treat schizophrenia, provided evidence for its efficacy of CBTp. Similarly, a computerised training package that targets reasoning processes was developed and was associated with promising improvements in participants (Waller, Freeman, Jolley, Dunn & Garety, 2011), suggesting it may be used in combination with CBT to improve the

overall efficacy of psychosis interventions. Few studies have documented the lack of effect of CBT in reducing psychosis relapse (Garety et al., 2015), the low implementation rate of NICE-recommended CBT and the significant shortage of NICE guidelines for CBT in schizophrenia (Haddock et al., 2014). Yiend et al. (under review) propose a more targeted intervention, focusing on specific symptoms or mechanisms. They tested the clinical feasibility of a novel psychological intervention (Cognitive Bias Modification for paranoia), manipulating biased interpretations toward more adaptive processing in order to reduce paranoia in patients. The results presented here may suggest that targeting content-specific cognitive processes may improve the efficiency of intervention.

4.6 Conclusions

In the current study, the causal role of interpretation bias in developing content specific emotional (paranoid/social anxiety) traits was demonstrated. Overall, the results of this longitudinal experiment generated promising findings in a subclinical population. A content specific causal role for negatively evaluative interpretation bias in developing the social anxiety trait was established. A causal role of persecutory interpretation in the development of paranoia was also observed. However, there was a significant interaction effect between negatively evaluative and persecutory interpretation bias: the accuracy of persecutory interpretation bias in predicting the severity of paranoia depended upon the magnitude of negative interpretation bias. Future research may extend this finding by demonstrating the cognitive specificity of interpretation bias in a clinical sample.

Chapter 5 Experiment 4 Testing Reciprocal Causality: Do Trait Emotions Maintain Corresponding Interpretation Biases in Social Anxiety and Paranoia?

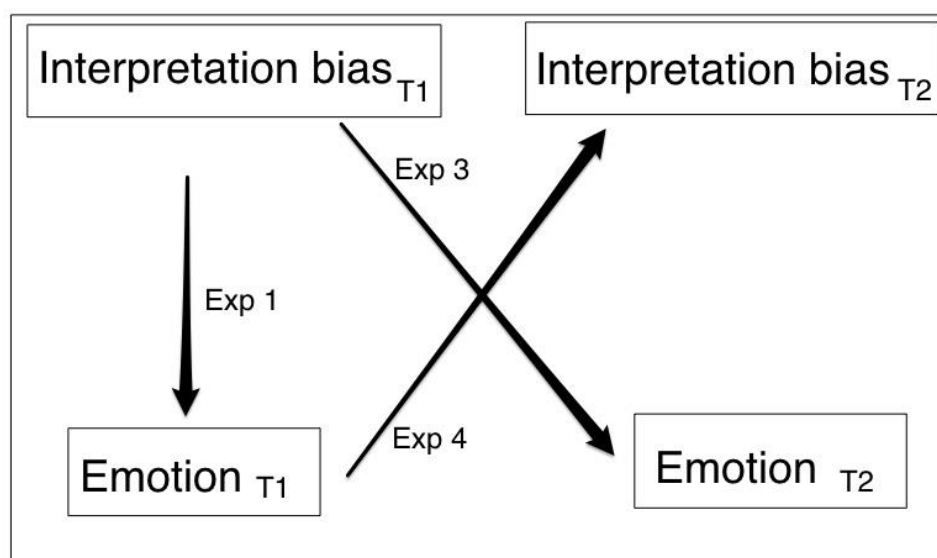
5.1 Experiment Overview

Cognitive theories suggest that there is a rolling cycle between cognition and emotion which facilitates the development and maintenance of emotional disorders. Vulnerable emotions produce biased cognition, whereas biased cognition maintains and enhances the severity of vulnerable emotions. In emotional disorders anxiety is suggested to be strongly associated with attention and interpretation to threatening information (Clark, 1999), while depression is suggested to be reliably associated with the selective memory of negative self-referent information (Mathews & MacLeod, 1994). In the model of positive symptoms of psychosis, Freeman and Garety (2002) argued that persecutory delusions place a greater emphasis on cognitive processes that are typically implicated in the maintenance of anxiety disorders; however, maintenance factors are presented differently, and psychosis individuals tend to hold persecutory beliefs for negative events.

As shown in Figure 5.1, Experiment 1 raised the possibility of a reciprocal relationship between trait emotions and corresponding interpretation biases. For example, in Experiment 1, on one side of the relationship the regression analysis showed that trait paranoia was a significant 'predictor' of the persecutory interpretation style, while the contrasting side of the relationship persecutory interpretation style was also a significant 'predictor' of trait paranoia. However, the cross-sectional design did not allow any causal explanation for these reciprocal relationship, only a direction of possibility. To further demonstrate this reciprocal relationship, Experiment 3 collated longitudinal data collected six months apart, and found a causal role of content-specific interpretation bias towards the corresponding trait emotion, which partially confirmed the vicious cycle proposed by cognitive theories of psychopathology. Thus, biased interpretation style (e.g. persecutory beliefs) significantly contributed to the increase in trait emotion (e.g. paranoia) level over a six-month time period.

However, we do not know if trait emotion (e.g. paranoia) was a significant predictor of the biased interpretation style (e.g. persecutory beliefs) across the same time period, enabling the forming of the cycle of psychopathology.

Figure 5.1: Prediction model for Experiments 1, 2 and 3



Note: T1 = first experiment session; T2 = second experiment session 6 month after T1; the opposite interpretation bias/emotion was controlled in each prediction model: Interpretation bias (T2) was controlled in the prediction model that interpretation bias (T1) predicted Emotion (T2); Emotion (T2) was controlled in the prediction model that Emotion (T1) predicted interpretation bias (T2).

This study demonstrates the opposing side of the reciprocal causality model using trait social anxiety and paranoia, by asking do interpretation biases in social anxiety and paranoia maintain the corresponding trait emotions, and whether there was a prolonged effect of trait emotions in the specific biased interpretations. Biased interpretations were tested via three cognitive experimental tasks with either socially anxious or paranoid congruent contents, the same as in Experiment 1. Data for this study were collected at the same time as Experiment 3 was being conducted. Data for trait emotions (social anxiety/paranoia) and interpretation bias were collected at the start (i.e. Time 1 trait scores, and Time 1 bias scores) and then again six months later (i.e. Time 2 trait scores, and Time 2 bias scores). Experiment 3 used Time 1 bias scores predicting Time 2 trait scores, while Experiment 4 used Time 1 trait scores predicting Time 2 bias scores. We were interested in whether specific trait emotions at a time point predict the interpretation style six months later. For example, a high severity

of paranoia at one time point predicts interpreting 'a stranger is standing across the street' as 'the stranger is stalking me' six months later, while a high severity of social anxiety at one time point predicts interpreting 'a stranger is standing across the street' as 'the stranger is laughing at me' six months later. Hierarchical regression analyses are used to examine the causal role of trait emotions in biased interpretations.

5.2 Background

The cognitive theory of psychopathology suggests a reciprocal relationship between anxiety and cognition, which may form the basis of a vicious cycle, and fuel the maintenance of anxiety once it is established (Mathew, 1988). It is speculated that negative thinking may both have a causal role in developing symptoms of anxiety, as well as being a symptom of anxiety. Despite the etiological importance of biased processing in social anxiety, the degree to which social anxiety elicits such negative processing may depend upon an individual's stable levels of trait vulnerability (Mathew & MacLeod, 1994). In the cognitive model of social anxiety proposed by Clark and Wells (2001), a socially anxious individual usually tends to develop negative beliefs about themselves (e.g. 'I sound boring'), which may lead individuals to appraise relevant social events as threatening, and to interpret ambiguous social information as signs of negative evaluation by others. Once a social situation is appraised in this manner, socially anxious individuals may then feel even more anxious. For example, a socially anxious individual usually tends to use internal information to infer how others evaluate them, which means they are trapped in a closed system in which most of their evidence for their fears are self-generated and other real responses becomes inaccessible. These interlinked vicious circles then maintain their anxiety and prevent disconfirmation of negative appraisals.

Johnson and Multhaup (1992) argued that not all emotions are equally amenable to cognitive explanations, as individual differences in trait vulnerability to anxiety or other emotions seem to be associated with the contents of information processing that are elicited by elevated levels of emotions. According to the cognitive model of the positive symptoms of psychosis proposed by Garety et al. (2001), 'dysfunctional negative schemas will be closely associated with levels of emotional distress' and 'the presence of emotional distress will also

contribute to the maintenance of the psychotic appraisal through other processes' (p. 192). Novel features of the suggested model outline the direct role of emotion and persecutory explanations in delusion formation; however, it does not make the proposed reciprocal nature of the relationship very explicit. Similar to the cognitive theory of social anxiety, persecutory delusions are conceptualised as threat beliefs, which is where biased beliefs are hypothesised to arise from individuals' emotionally significant experiences, and lead to the receipt of confirmatory evidence and prevent dis-confirmatory processing. The cognitive model of persecutory delusions by Freeman et al. (2002), suggests that emotional experiences are directly associated with the content of delusional beliefs. 'The cognitive content of emotions will have been expressed in the delusions and, in turn, the content of the delusions will contribute to the maintenance and exacerbation of the emotion' (p. 340). As shown in Figure 5.2, although there are dynamic interactions between emotion and cognitive bias in the formation and maintenance of a persecutory delusion, the model does not explicitly suggest this same reciprocal relationship as proposed here. The vicious cycle between cognition and emotion that facilitates the development and maintenance of emotion disorders has not yet been applied in psychosis. Therefore, one of the original contributions of this thesis is to apply the reciprocal relationship between cognition and emotion in psychosis, and to test whether a rolling cycle exists in the formation and maintenance of psychosis.

There are a number of studies that have demonstrated the reciprocal relationship between trait emotions (social anxiety/paranoia) and biased interpretations, which were reviewed in Experiment 1 (cross-sectional design), but fewer studies have investigated the causal role of interpretation bias in social anxiety/paranoia, which were reviewed in Experiment 3 (longitudinal design). However, rather than specifically testing both directions in the cross-sectional data obtained, which would directly address the question of reciprocal causality, these studies only tested the relationship in one or other direction. We know little about the effects of trait emotion on interpretation style in the longer term, and to what extent trait emotion can predict one's interpretation style in the future. Whether trait emotion may precede the development of a corresponding interpretation style within a longitudinal setting, and whether associations will fade over time remains unknown.

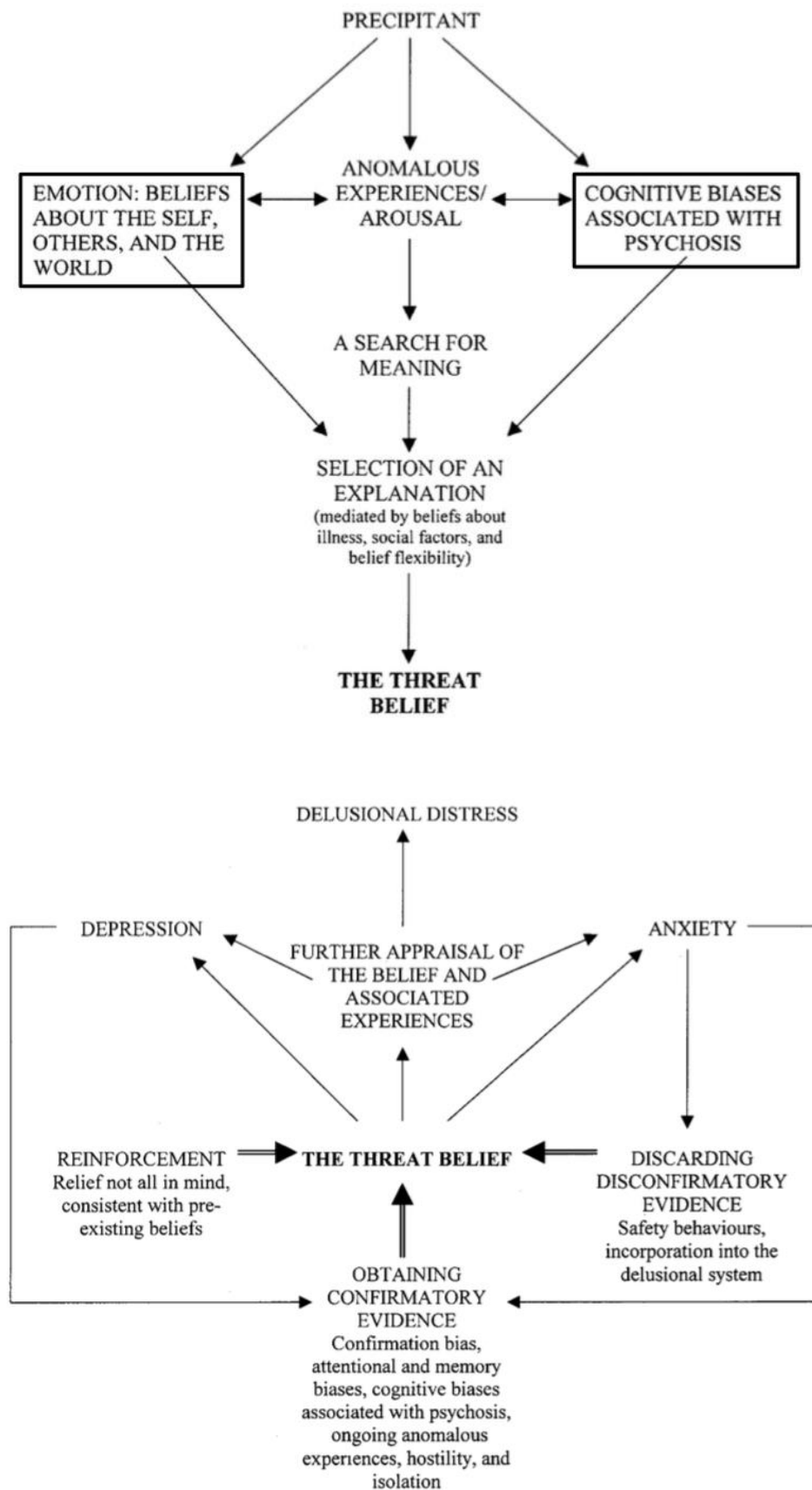


Figure 5.2: The formation of a persecutory delusion

(Freeman et al., 2000)

Reviews of previous studies have shown that they are yet to directly investigate the reciprocal causality model in one dataset, within a longitudinal setting, and in both directions: from emotion to cognition, and from cognition to emotion. Thus, the strong design of this study provides a unique opportunity to address these important questions. Following the findings of Experiment 3, which tested the causality of interpretation bias and emotion traits, this study will evaluate whether a specific trait emotion at a given point in time is associated significantly at a later point in time with one interpretation style and not the other.

Data for this study was collected during Experiments 1 and 3. We used trait scores of social anxiety/paranoia to predict composite scores of interpretation bias from three paradigms: the Similarity Rating Task (SRT), the Scrambled Sentences Task (SST), and the Word Sentence Relatedness Paradigms (WSAP) in a longitudinal study of a wide ranging population tested at two time points over an approximately six-month time interval. For example, high paranoia level at one time point predict the interpretation of 'a stranger is standing across the street' as 'the stranger is stalking me' six months later, while high social anxiety level at one time point predict the interpretation of 'a stranger is standing across the street' as 'the stranger is laughing at me' six months later. Hierarchical regression analyses are used to examine the trait specific association between trait social anxiety/paranoia and interpretation biases.

We have tested the reciprocal relationship between trait emotion and interpretation bias, and focus on the causal role of trait emotion in the maintenance of interpretation style: whether a specific trait emotion would add to the prediction of the specific content of interpretation beyond the effects of other emotion traits.

- I. The trait social anxiety will contribute more to the prediction of negatively evaluated (social anxiety congruent content) interpretation bias than trait paranoia.
- II. Conversely, the trait paranoia will contribute more to the prediction of the persecutory (paranoia congruent content) interpretation bias than trait social anxiety.

5.3 Methods

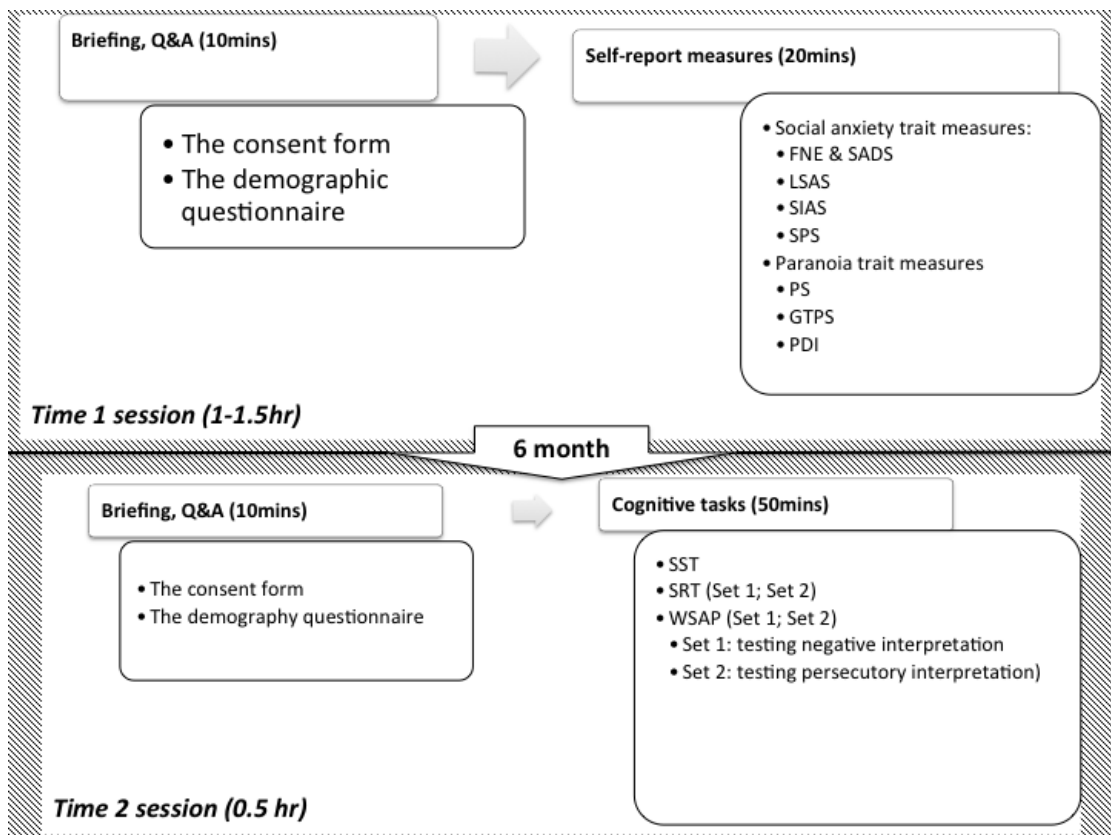
Data for Experiment 4 was collected at the same time as when Experiment 3 was being conducted. In total, 71 individuals with a wide range of scores for social anxiety and paranoia

were tested using a battery of self-report personality measures and tests of interpretation bias at two time points six months apart. Experiment 4 used trait data from Time 1 personality measures and interpretation bias data from Time 2 cognitive tasks.

5.3.1 Procedure

Session 1 lasted around 1 hour to 90 minutes and varied across individuals, while session 2 lasted for around 30 minutes. All participants were informed of the inclusion criteria again before starting each session. As shown in Figure 5.3, during session 1 participants were firstly asked to complete a consent form and demographics questionnaire, followed by self-report measures; this took approximately 20-30 minutes. In session 2, participants were asked to complete a consent form and a demographics questionnaire. In order to measure interpretation biases representing negative interpretation (social anxiety related) and persecutory interpretation (paranoia related), three cognitive experimental tasks were utilised, each containing two sets of materials reflecting both types of content. Two parallel versions of each task were developed, and used in in counterbalanced order across participants. All measures were presented to participants ahead of the interpretation tasks. Self-reported measures and tasks were presented in two counterbalanced, fixed random orders across participants. A random/counterbalanced design reduces the chance of order effects, whereby a measure/task or other factors adversely influences the results.

Figure 5.3: Experiment procedure



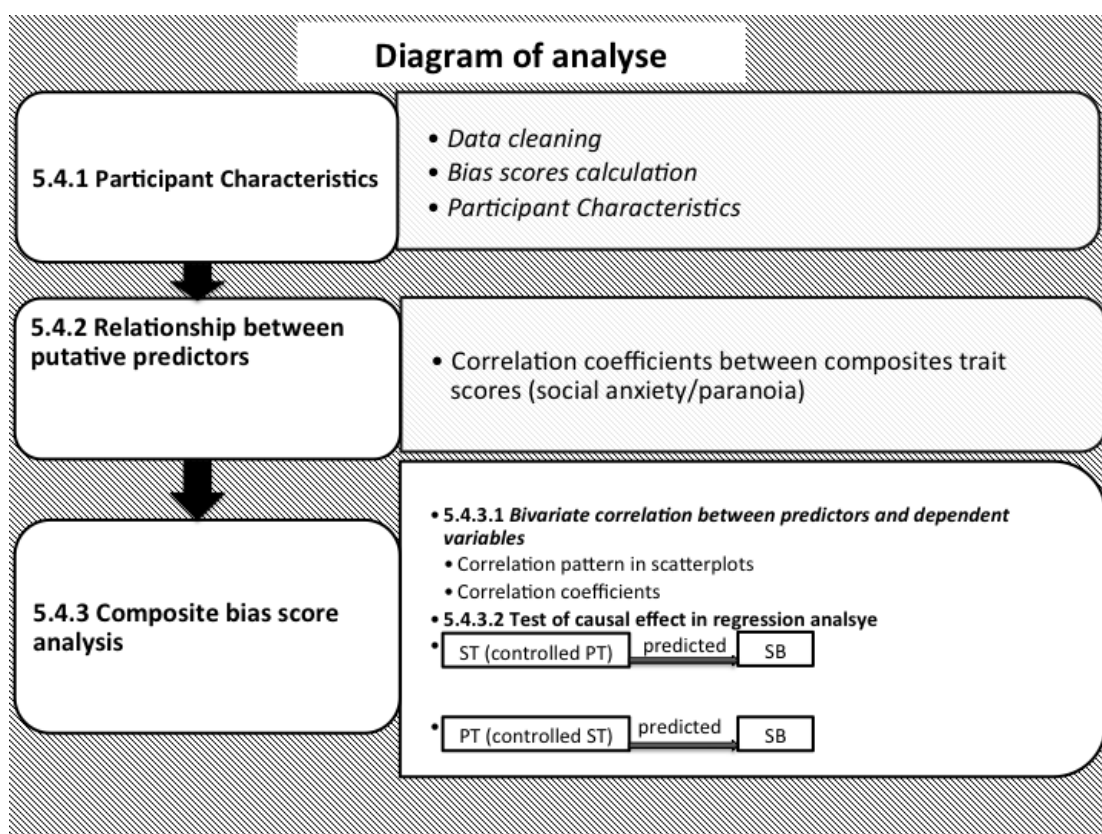
Note: Participants were asked to complete the self-report measures ahead of the tasks, which were presented in two counterbalanced, fixed orders. LSAS: Liebowitz Social Anxiety Scale (Liebowitz, 1987); SIAS: Social Interaction Anxiety Scale (Mattick & Clarke, 1998); SPS: Social Phobia Scale (Mattick & Clarke, 1998); GTPS: Green et al. Paranoid Thought Scales (Green et al., 2008); PS: Self-report Paranoia Scale (Fenigstein & Venable, 1992); PDI: Peters Delusions Inventory (PDI; Peters et al., 1999). SRT: Similarity Ratings Task (SRT, Based on Eysenck et al. 1991); SST: Scrambled Sentences Task (SST; Based on Wenzlaff & Bates, 1998); WSAP: The Word-Sentence Association Paradigm (WSAP, Based on Beard & Amir, 2010)

5.3.2 Analysis Design

Our key concern during the analyses was the influence of participants' emotional trait severity on their interpretation bias six months later. To test our hypothesis we generated four composite scores by standardising ($M = 0$, $SD = 1$) each measure/task score, then averaging them. The four composites are: Time 1 composite of social anxiety trait (ST) measures (SADS, LSAS, SIAS, and SPS); Time 1 composite of paranoia trait (PT) measures (PS, GTPS, and PDI); Time 2 composite of negatively evaluated interpretation bias (SB) scores (SST, SRT, and WSAP); and Time 2 composite of persecutory

interpretation bias (PB) scores (SST, SRT, and WSAP). The reason for using composite scores in this analysis is to achieve the clarity possible by employing an analysis based on composite trait scores, and the fact that composite bias scores are able to more obviously map our hypothesis. Composite scores provide convergent validity for the construct measured by including several measures of the same phenomenon, and results using composite scores should be a reflection of the results from individual scores.

Figure 5.4: Analytical approach



Note: The self-report measures were presented to participants ahead of the tasks, which were presented in two counterbalanced, fixed orders. ST= Time 1 composite of social anxiety trait measures; PT= Time 1 composite of paranoia trait measures; SB= Time 2 composite of negatively evaluated interpretation bias scores; PB= Time 2 composite of persecutory interpretation bias scores.

In addition, composite scores were calculated for social anxiety/paranoia related bias in Time 1, and for social anxiety/paranoia measures in Time 2. We generated the composites by standardising ($M = 0$, $SD = 1$) participants' scores for each corresponding measure and task, and then averaged across them separately. These represent the Time 1 social anxiety trait and paranoia trait, and Time 2 social anxiety related interpretation bias, and paranoia

related interpretation bias, separately. Using the composites we employed a bivariate correlation to check if the patterns of the relationship between the tested variables are linear. Finally, a hierarchical regression was conducted to test the causal effect of trait social anxiety and paranoia in interpretation bias.

In order to test our hypothesis directly, we tested the model explaining the content of the interpretation biases (SB/PB) via two analyses. In analysis one we entered the content matched trait as the first independent variable firstly, and then the converse (content incongruent) trait secondly. For example, in explaining the SB, ST was entered into the first block, and PT into the second block. In analysis two, we entered the converse trait as the first independent variable, and the content matched trait as the second. Following the example above, we entered PT into the first block, and ST into the second block. Analysis two allowed a strength test of the content-specific bias for explaining its matched interpretation bias composite, when controlling the converse. This generated two Δ Adjusted R^2 , and the change of the Δ Adjusted R^2 from the two analysis indicated that the additional variance in the bias composite is accounted for by one trait composite over, and above the other. Which of the Δ Adjusted R^2 values is the greater indicates which direction of the trait explains the most variance in the outcome bias composites.

5.4 Results

5.4.1 Participant Characteristics

5.1.1.1 Data Cleaning

Preliminary analyses were conducted to ensure there were no violations of the assumptions of normality, linearity, and homoscedasticity. In order to recruit participants with wide-ranging scores on all scales, we have not filtered any scores from our data except the reaction time data for the WSAP task. To remove the influence of spuriously long response times, we excluded data from trials with reaction times shorter than 50ms or longer than 1500ms. This time limitation follows the design of the original WSAP by Beard and Amir (2010) and resulted in the elimination of 2.65% of trials. There were 11 missing data points, which were treated via pairwise deletions. An inspection of the missing data did not suggest any

systematic problems with the measurement tools or methods, and the missing data appeared to be randomly distributed.

5.1.1.2 Calculation of Bias Scores

In order to compare the reaction times or rating indices with the self-report indices, we calculated bias scores for the social scenario sentences. Bias scores from each task were calculated using the equations listed in Table 5.1. We calculated two bias scores for each task, reflecting the negatively evaluated bias and persecutory bias. Larger bias scores indicate more bias toward threat interpretations, and further away from benign interpretations.

Table 5.1: Equations of bias scores

Task name	Bias score	Equations	Range of values
SST	Negative bias	Interpretation Bias=(Social anxiety statements/All statements completed)*100 %	0, 100
	Persecutory bias	Interpretation Bias=(Paranoia statements/All statements completed)*100 %	0, 100
SRT	Negative bias	Interpretation Bias= Mean of ratings on all Target Social anxiety -Mean of ratings on all Target Benign	-3, 3
	Persecutory bias	Interpretation Bias= Mean of ratings on all Target Paranoia -Mean of ratings on all Target Benign	-3, 3
WSAP	Negative bias	Interpretation Bias = Reaction times (Social anxiety meaning reject – Social anxiety meaning endorse)	-1500, 1500
	Persecutory bias	Interpretation Bias = reaction times (Paranoia meaning reject – Paranoia meaning endorse)	-1500, 1500

Note: negative bias represents social anxiety related interpretation; persecutory bias represents social anxiety related interpretation.

5.1.1.3 Descriptive Statistics

Means and standard deviations for each measures and tasks are presented in Table 5.2.

Table 5.2: Trait scores and bias scores

		Mean (SD)			
		Social anxiety		Paranoia	
		Time 1 (n=84)	Time2 (n=71)		Time 1 (n=84) Time2 (n=71)
Emotional traits	FNE	12.20 (4.50)	13.21 (3.17)	PS	33.55 (13.02) 32.35 (12.71)
	SADS	6.61 (6.28)	6.62 (7.30)	GTPS	48.60 (23.28) 44.18 (17.68)
	LSAS	36.01 (20.96)	36.14 (22.38)	GPTS_SocialReference	25.35 (11.53) 23.72 (10.35)
	LSAS_Anxiety	19.54 (11.09)	20.13 (11.55)	GPTS_Persecution	23.25 (12.36) 20.46 (8.09)
	LSAS_Avoidance	16.75 (11.08)	16.00 (12.00)	PDI	52.69 (42.93) 45.11 (41.64)
	SIAS	19.74 (11.94)	19.77 (12.40)	PDI_YesNo	6.23 (4.35) 6.10 (4.58)
	SPS	11.36 (11.02)	11.08 (11.92)	PDI_distress	14.29 (13.23) 14.13 (14.36)
				PDI_preoccupation	14.46 (13.42) 13.58 (13.36)
				PDI_conviction	17.71 (13.48) 17.41 (15.05)
Interpretation bias (Time 1, n=71)	SST (%)	21.87 (16.50)	22.51 (17.90)	SST (%)	28.08 (18.03) 27.42 (19.10)
	SRT	1.95 (0.45)	2.01 (0.60)	SRT	1.86 (0.46) 1.93 (0.56)
	WSAP	-27.82 (115.31)	-33.97 (129.60)	WSAP	-44.17 (108.01) -24.82 (130.19)

Note: Time 1= first experiment session; Time 2= second experiment session 6 month after Time 1; LSAS: Liebowitz Social Anxiety Scale (Liebowitz, 1987); SIAS: Social Interaction Anxiety Scale (Mattick & Clarke, 1998); SPS: Social Phobia Scale (Mattick & Clarke, 1998); GTPS: Green et al. Paranoid Thought Scales (Green et al., 2008); PS: Self-report Paranoia Scale (Fenigstein & Vanable, 1992); PDI: Peters Delusions Inventory (PDI; Peters et al., 1999). SRT: Similarity Ratings Task (SRT, Based on Eysenck et al. 1991); SST: Scrambled Sentences Task (SST; Based on Wenzlaff & Bates, 1998); WSAP: The word-sentence association paradigm (WSAP, Based on Beard & Amir, 2010)

To test the hypothesis that a specific emotional trait would add to the prediction of one interpretation type beyond the effects of the other emotional trait, we conducted correlational analysis followed by linear regression analysis.

5.4.2 Relationship between Putative Predictors

According to Tabachnick and Fidell (1996), independent variables with a bivariate correlation more than 0.80 should not be included in multiple regression analyses. The correlation coefficient between social anxiety trait and paranoia trait was $r = 0.69$, $p < 0.001$, which is < 0.80 , and suggests it will be feasible to assess trait social anxiety and trait paranoia as

potentially different constructs (Baguley, 2012) and there was arguably no collinearity problem. Thus, these can be used as independent variables to test the corresponding interpretation bias six months later.

5.4.3 Main Analyses

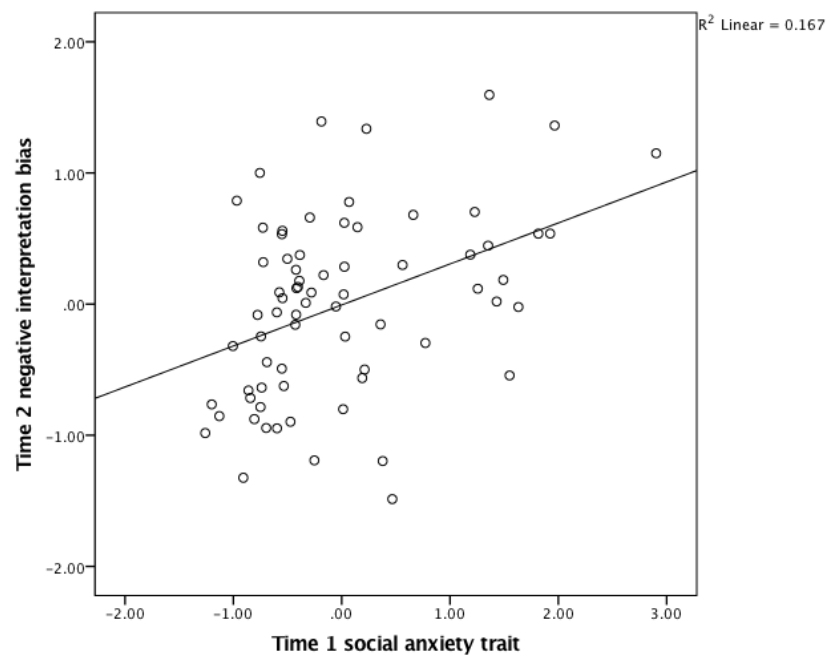
Composites for participants' scores on emotional traits from Time 1 session and interpretation bias from Time 2 session were generated to yield four composite scores representing: Time 1 social anxiety trait (ST); Time 1 paranoia trait (PT); Time 2 social anxiety related bias (SB); and Time 2 paranoia related bias (PB), individually. The negative interpretation bias scores from Time 1 SST, SRT and WSAP were averaged to generate a composite score which reflected social anxiety related interpretation bias. The persecutory interpretation bias scores from Time 1 SST, SRT and WSAP were averaged to generate a composite score which reflected paranoia related interpretation bias (see Table 5.1 for the calculation of bias scores). The composite score representing paranoia trait was calculated by averaging Time 2 PS, GTPS, and PDI, while the composite score representing social anxiety trait was calculated by averaging the Z scores of Time 2 SADS, LSAS, SIAS, and SPS.

5.1.1.4 Bivariate Correlation between Predictors and Dependent Variables

Correlation patterns in scatterplots

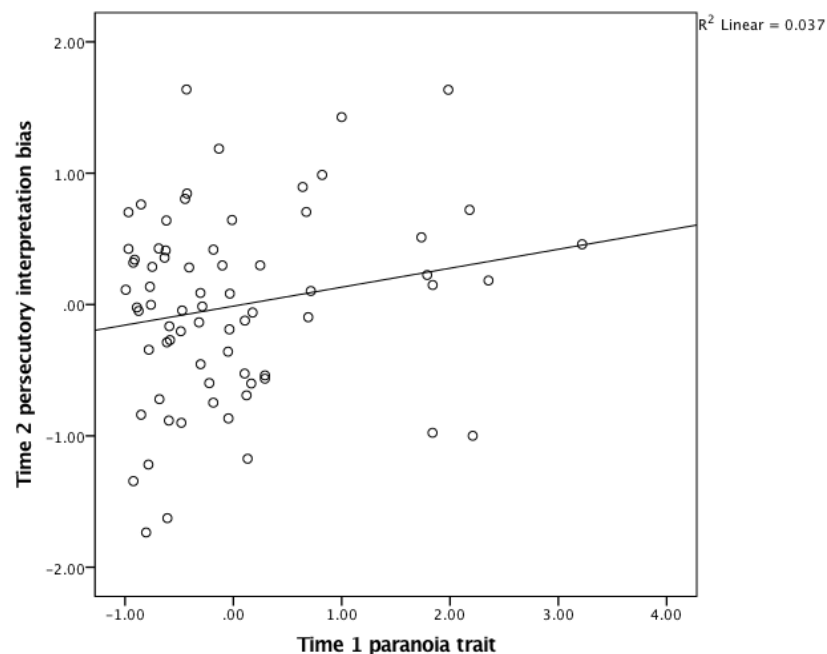
Scatterplots were generated to visually check if patterns of the relationship between the tested variables are linear and to identify outliers of the calculated composites (observations lying away from the main body of points). Figure 5.5 clearly shows that Time 1 social anxiety trait and Time 2 negative interpretation bias are linear, while Figure 5.6 shows that Time 1 paranoia trait and Time 2 paranoid interpretation bias are also clearly linear.

Figure 5.5: Correlation between Time 1 social anxiety trait and Time 2 negative interpretation bias



Note: $n=71$; Time 1= first experiment session; Time 2= second experiment session 6 months after Time 1; negative interpretation bias represents social anxiety related meaning; persecutory interpretation bias represents paranoia related meaning.

Figure 5.6: Correlation between Time 1 paranoia trait and Time 2 paranoid interpretation bias



Note: $n = 71$; Time 1 = first experiment session; Time 2 = second experiment session 6 months after Time 1; persecutory interpretation bias represented paranoia related meaning.

Correlation coefficients

The results of the correlation analysis between Time 1 traits predictors and Time 2 dependent measures are presented in Table 5.3. The Time 2 negative interpretation bias (SB, which represents socially anxious meaning) was significantly correlated with the Time 1 social anxiety trait, but not Time 1 paranoia trait. However, the Time 2 persecutory interpretation bias (PB, which represents paranoid meaning) was not significantly correlated with the Time 1 paranoia trait, but was significantly correlated with the Time 1 social anxiety trait.

Table 5.3: Correlation coefficients of Time 1 trait composites (ST/PT) and Time 2 interpretation bias (SB/PB)

		Time 1			
		ST		PT	
		r	p	r	p
Time 2	SB	0.41	<0.001	0.23	0.056
	PB	0.35	0.003	0.19	0.108

Note: n = 66; Time 1 = first experiment session; Time 2 = second experiment session 6 months after Time 1; ST = Time 1 composite of social anxiety trait measures; PT = Time 1 composite of paranoia trait measures; SB = Time 2 composite of negatively evaluated interpretation bias scores; PB = Time 2 composite of persecutory interpretation bias scores.

5.1.1.5 Test of Causal Effect via Regression Analysis

To test our hypotheses, we ran hierarchical regression analyses to assess the role of specific emotion traits in the prediction of trait matched interpretation bias 6 months from baseline. In analysis 1 the baseline composite of social anxiety trait (ST) was entered into the first block, and the baseline composite of paranoia trait (PT) was entered into the second block to predict the negative interpretation bias (SB) 6 months from baseline. The results showed that both model 1 (entering: ST) and model 2 (entering: PT) were significant. Model 1 indicated that 15.53% of the variance in the dependent variable could be accounted for by the ST (Adjusted $R^2 = 0.1553$, $F(1, 69) = 13.87$, $p < .001$). Thus, the ST composite significantly explained the variance in the SB composite. As shown in Table 5.4, when the PT composite was added to the model, the change in the Adjusted R^2 value suggested that the variance was decreased by 0.11% when PT was accounted for (Adjusted $R^2 = 0.1542$, $F(2, 68) = 7.38$, $p = 0.001$). Only the ST composite reached significance as an independent

predictor. In analysis 2 PT was entered into the first block, and ST into the second block. The results showed that the model was only significant after adding ST into the prediction model (Adjusted $R^2 = 0.1542$, $F(2, 68) = 7.38$, $p = 0.001$), indicating that PT alone did not significantly predict the model. Therefore, only the Time 1 baseline ST score was able to significantly explain the variance in the SB composite 6 months later. In summary, the participants that had higher scores in social anxiety measures showed more negative interpretation (social anxiety related interpretation) 6 months later, while participants with higher scores in paranoia measures showed more persecutory interpretation (paranoia related interpretation) 6 months later.

To predict the persecutory interpretation bias (PB) 6 months from baseline, in Analysis 1, the baseline composite of paranoia trait (PT) was entered into the first block, and the baseline composite of social anxiety trait (ST) was entered into the second block. The results showed that the model was only significant after adding ST into the prediction model (Adjusted $R^2 = 0.1054$, $F(2, 68) = 5.13$, $p = 0.008$), and PT alone did not significantly predict the model. In analysis 2 ST was entered into the first block, and PT into the second block. The results showed that both model 1 (entering: ST) and model 2 (entering: PT) were significant. Model 1 indicated that 10.96% of the variance in the dependent variable could be accounted for by ST (Adjusted $R^2 = 0.1096$, $F(1, 70) = 9.62$, $p = 0.003$). Thus, the ST composite could significantly explain the variance in the PB composite. As shown in Table 5.5., when the PT composite was added to the model, the change in the Adjusted R^2 value suggested that the variance was decreased by 0.42% when PT was accounted for (Adjusted $R^2 = 0.1054$, $F(2, 70) = 5.13$, $p = 0.008$). Only the ST composite reached significance as an independent predictor. Therefore, only the Time 1 baseline ST score was significant in explaining the variance in the PB composite 6 months later. In summary, the participants with higher scores in social anxiety measures showed more persecutory interpretation (paranoia related interpretation) 6 months later.

Table 5.4: Statistical predictors of Time 2 negative interpretation bias composite

		R	R ²	Adjusted R ²	sig	Independent measures	B	Beta	t	Sig.
Analysis 1	Model 1	0.4091	0.1673	0.1553**	<0.0001	ST	0.31	0.41	3.72	<0.001
	Model 2	0.4224	0.1784	0.1542*	0.001	ST	0.40	0.52	3.24	0.002
						PT	-0.11	-0.15	-0.96	0.34
Adding PT decreases the variance explained ($\Delta R^2 = 0.0011$) = -0.11%;										
Analysis 2	Model 3	0.2275	0.0518	0.0380	0.06	PT	.016	0.23	1.94	0.06
	Model 4	0.4224	0.1784	0.1542*	0.001	PT	-0.11	-0.15	-0.96	0.34
						ST	0.39	0.52	3.24	0.002
The model was only significant when ST was added										
Analysis summary: variance in SBs were only explained by ST (15.53%) and ST & PT together (15.42)										

Note: n = 71; the dependent variable = Time 2 negative interpretation bias (SB); ST = Time 1 composite of social anxiety trait measures; PT = Time 1 composite of paranoia trait measures; SB = Time 2 composite of negatively evaluated interpretation bias scores; PB = Time 2 composite of persecutory interpretation bias scores.

Table 5.5: Statistical predictors of the Time 2 persecutory interpretation bias composite

		R	R ²	Adjusted R ²	P	Independent measures	B	Beta	t	Sig.
Analysis 1	Model 1	0.1924	0.0370	0.0231	0.108	PT	0.14	0.19	1.63	0.11
	Model 2	0.3619	0.1310	0.1054	0.008	PT	-0.10	-0.14	-0.82	0.41
						ST	0.36	0.45	2.71	0.008
The model was only significant when ST alone were entered										
Analysis 2	Model 3	0.3498	0.1223	0.1096 *	0.003	ST	0.28	0.35	3.10	0.003
	Model 4	0.3619	0.1310	0.1054 *	0.008	ST	0.36	0.45	2.71	0.008
						PT	-0.10	-0.14	-0.82	0.41
Adding PT decreases the variance explained ($\Delta R^2 = -0.0042$) = -0.42%										
Analysis summary: variance in PB were only explained by ST (10.96%), and ST & PT together (10.54%)										

Note: n = 71; the dependent variable = Time 2 persecutory interpretation bias (SB); ST = Time 1 composite of social anxiety trait measures; PT = Time 1 composite of paranoia trait measures; SB = Time 2 composite of negatively evaluated interpretation bias scores; PB = Time 2 composite of persecutory interpretation bias scores.

5.5 Discussion

In this study, we proposed that specific emotion traits at a given time point predict corresponding interpretation bias scores at a later time point. Thus, we predicted that the trait social anxiety would carry more weight than the trait paranoia in the prediction of negatively evaluated (social anxiety congruent content) interpretation bias. Conversely, we predicted that the trait paranoia would carry more weight than the trait social anxiety in the prediction of persecutory (paranoia congruent content) interpretation bias. The discussion commences with a summary of the results presented in Table 5.6, and explanations for these results are then discussed.

Table 5.6: Summary of the key findings

Dependent variables	Results	Does the corresponding bias better explain the variance in the related (i.e. content matched) traits?
Time 2 SB	Variance in SB is only explained by ST (15.53%), and ST and PT together (15.42)	✓
Time 2 PB	Variance in PB is only explained by ST (10.96%), and ST and PT together (10.54%)	×

Note: social anxiety content matches are shown in the grey row, and paranoid in the white row. ST = Time 1 composite of social anxiety trait measures; PT = Time 1 composite of paranoia trait measures; SB = Time 2 composite of negatively evaluated interpretation bias scores; PB = Time 2 composite of persecutory interpretation bias scores.

In the test of negative evaluated interpretation bias (SB, representing social anxiety related meaning), we found that only the trait social anxiety explained the variance, while the trait paranoia (PT) contributed nothing to the model. Therefore, only the trait social anxiety significantly predicted a negative interpretation bias 6 months later, while the trait paranoia did not. This suggests that individuals with a higher severity of social anxiety at the first time point maintained a biased interpretation style in a negatively evaluative way 6 months later, while individuals with a higher severity of paranoia did not.

In the test of persecutory interpretation bias (PB, represented paranoia related meaning), we also found that the trait social anxiety explained the variance, while the trait paranoia (PT) did not significantly contribute to the model. Therefore, only the trait social anxiety significantly predicted persecutory interpretation bias 6 months later, while the trait paranoia

did not. This suggests that individuals with a higher severity of social anxiety at the first time point developed a biased interpretation style in a persecutory 6 months later, while individuals with a higher severity of paranoia did not.

5.5.1 Interpretations of the Results

Hypothesis I was clearly supported, the trait social anxiety contributed more to the prediction of negatively evaluated (social anxiety congruent content) interpretation bias than the trait paranoia, while Hypothesis II was not supported, as the trait social anxiety contributed more to the prediction of persecutory (paranoia congruent content) interpretation bias than the trait paranoia.

These results support cognitive theories of social anxiety (Clark & Wells, 1995; Hirsch & Clark, 2004; Morrison & Heimberg, 2013) at a subclinical level. Socially anxious individuals engage in prolonged, negatively biased, post-event processing (Clark, 2001), whereby the post event-processing involves interpreting social information in a manner that tends to be recurrent and intrusive (Rachman et al., 2000). Furthermore, the results of the previous cross sectional study (Experiment 1) and this longitudinal study demonstrate that socially anxious individuals produce both a state and a persistent trait interpretation style for ambiguous socially information. Thus, when combined with the results of Experiment 3, which showed a significantly causal role of interpretation bias in social anxiety, this clearly suggests the reciprocal causality of the trait social anxiety in the corresponding interpretation bias. The results of this study are also consistent with the cognitive theory of emotional disorders. Mathews and MacLeod (1994) argued that emotions could be associated with effects that are relatively specific not only to certain types of cognitive processes for that information but also to particular cognitive content. Thus, individual differences in trait vulnerability to social anxiety or paranoia are associated with the content of interpretive information that are elicited by elevated levels of anxiety.

5.5.2 Unexpected Finding and Possible Explanations

The results in relation to hypothesis II are both interesting and meaningful, as the trait social anxiety contributed more to the prediction of persecutory (paranoia congruent content) interpretation bias 6 months later, than the trait paranoia. This result is not consistent with

the most methodologically robust measure of interpretation bias from the cross sectional data of Experiment 1, where paranoia is more strongly associated with persecutory interpretation bias than negatively evaluated interpretation bias. Thus, paranoid individuals produce persecutory interpretation bias for ambiguous social information, although this interpretation style was not persistent. The rolling cycle proposed by cognitive theories has not been confirmed by the paranoia data.

A similar finding regarding the contribution of the trait social anxiety was reported in a study with a 3-month interval (Startup, Freeman & Garety, 2007). The severity of anxiety was found to be associated with high levels of persecutory delusion distress and with the persistence of delusions over three months. The notable contributions of the trait social anxiety in predicting persecutory interpretation bias, to a certain extent support the cognitive model of persecutory delusions (Freeman et al., 2002), where paranoia is one of the key components. It is suggested that a high severity of pre-existing anxiety together with social ambiguity is particularly significant to the cognitive component of paranoid individuals. For instance, anxious feelings may provide the threat content integral to a persecutory belief; anxiety and worry processes may lead to paranoid thoughts becoming distressing; and anxiety related processes, such as worry and safety behaviours, are hypothesised to contribute to the persistence of delusional beliefs (Startup, Freeman & Garety, 2007). Given the complex nature of psychosis and paranoia, Garety and Freeman (1999) have argued that only a multifactorial understanding of symptom development and maintenance may adequately reflect the phenomenon.

5.5.3 Limitations and Implications

Some limitations and implications for this longitudinal study were discussed in Experiment 3. For example, the subclinical sample and small sample size of this study ($n = 71$) limits the power of the results. We need to be cautious in reaching a conclusion concerning the significant impact of trait emotions in the prediction model, and the study needs to be replicated with a larger sample and in a clinical population. It was impossible to maintain a constant time interval between the Time 1 baseline measurements and the Time 2 follow-up, and six months was not an exact planned interval; whether this affected our results is unclear. In addition, the lack of a contribution due to the trait paranoia to persistent

persecutory interpretation bias calls for further investigations to assess the extent that the trait paranoia produces persecutory cognition. The design of our study only allowed a six month interval, thus we know nothing about the dynamic changes of the relationship between the trait paranoia and the persecutory interpretation style.

The findings of our results are based on a subclinical population, and we do not know if the absent influence of the trait social anxiety on persecutory interpretation bias applies to the cognitive mechanism of clinically paranoid symptoms. Thus, replicating the study in a clinical population is suggested to test the effect of a clinical level of paranoia in the maintenance of persecutory interpretation style. Furthermore, our findings are based only on the focus of biased interpretation, and a future study could expand the test to other information processes, such as attention and memory. Although the findings from subclinical data limit the clinical implications of this study, the significant contribution of social anxiety and absent contribution of paranoia in the maintenance of persecutory interpretation style benefits the clinical prospective, as it highlights directions for applying interventions designed for social anxiety to induce paranoia related cognitive bias.

5.6 Conclusions

This study has demonstrated the reciprocal causality of the trait emotion (social anxiety/paranoia) in corresponding interpretation bias. We found a reciprocal causality of the trait social anxiety in corresponding negatively evaluative interpretation bias, while there was an absent contribution of the trait paranoia to persecutory interpretation bias, which was instead due to the trait social anxiety. These findings confirm the vicious circle proposed by cognitive theories of social anxiety, and offer insight into the relationship between paranoia and persecutory interpretation bias. Theoretical accounts of cognitive processes in paranoia could be refined and revised in light of this empirical finding obtained from a study with a longitudinal design. The absence of the trait paranoia in maintaining persecutory interpretation bias should be reassessed in a clinical sample to improve the clinical implications. Future studies may also extend the current investigation to other cognitive processes in order to assess the reciprocal relationships between emotions and cognitive processes.

Chapter 6 Experiment 5 Specificity of Interpretation Bias in Clinical Disorders: Social Phobia versus Paranoid Psychosis

6.1 Experiment Overview

Our findings across a subclinical population consistently confirmed cognitive specificity (specific type of interpretation bias associated with the matching psychopathological trait), and cognitive vulnerability (specific interpretation bias precedes development of corresponding emotional traits) in social anxiety and paranoia. The longitudinal data (Experiment 3) also suggested the causal effect of the persecutory interpretation bias is especially pronounced when participants also display a severe negative interpretation bias. However, both our findings and reports in the literature have relied heavily on experimental work from subclinical samples, and it is unknown whether the same cognitive pattern can be generalised from these subclinical samples to the clinical situation. For example, a recent study by Yiend et al. (2015) found that general anxiety disorder patients showed a pattern of attentional biases opposite to those observed using similar methods in subclinical samples. This challenges current assumptions that studies in subclinical analogue samples can be generalised to the corresponding clinical disorder. Therefore, it is important to establish whether the results for the subclinically socially anxious groups and paranoid group can be generalised to the corresponding clinical groups. This is also crucial in enabling the identification of appropriate cognitive mechanisms to target in the treatment of general anxiety disorder and psychosis, as biases in different components of interpretation orienting could have different clinical implications. Using a group comparison design within three clinical samples (SAD, paranoid psychosis, non-paranoid psychosis) and healthy controls, this study was conducted to determine whether the content specific pattern previously found via correlational data within a wider population range remains valid when compared to each diagnosed patient group directly. Furthermore, we included a non-paranoid psychosis group in this experiment to further investigate if this specificity would be less apparent in patients with fewer paranoid symptoms ('non-paranoid' group) compared to those with more paranoid

symptoms ('paranoid' group). Four out of six trait measurements from previous experiments have been selected to target the current clinical sample. The same cognitive tasks from the longitudinal experiment were adopted in order to maintain the consistency of the tested interpretation bias. Mixed ANOVA analyses were used to examine whether the symptom characteristics of paranoid psychosis and social phobia can be distinguished via the interpretation of emotionally ambiguous information, and the same between paranoid and non-paranoid psychosis.

6.2 Background

Clinical symptoms of social phobia are a significant comorbidity during first-episode psychosis, with a co-morbid diagnosis present in 36% of psychosis outpatients (Michail & Birchwood, 2009; Pallanti, Quercioli & Hollander, 2004). This is one of the core components of psychosis syndrome, and develops in line with positive and negative symptoms (Birchwood & Trower, 2006). Some studies found social anxiety to be a pre-morbid and vulnerability indicator for psychosis (Johnstone, 2005; Owens, Asmundson, Hadjistavropoulos & Owens, 2004), while others have argued it emerges as a psychological reaction during recovery from psychosis (van der Gaag, Hageman & Birchwood, 2003). A framework for understanding social anxiety in psychosis has revealed links between cognitive vulnerability and psychosis symptoms, whereby individuals with psychosis experience a heightened awareness of their diagnoses (Birchwood et al., 2000). These people feel at risk of being either passively avoided (e.g. being ignored) or actively rejected (Gilbert, Boxall, Cheung & Irons, 2005), which may alert them to their vulnerability, their lack in social competitions (e.g. attractiveness to others, acceptance in social groups), and lead them to further evolve various threat-defence emotion (e.g. fear of developing intimate relationships) and strategies (e.g. avoiding social contact) (Brown, Harris & Hepworth, 1995). These social anxiety-based beliefs are magnified in people with psychosis due to the issue of cognitive vulnerability (Gilbert & Trower, 2001). Both socially anxious individuals and those with psychosis fear and avoid social contacts (Steel et al., 2010); however, the content they are concerned about is not shared. A socially anxious individual will centre around a theme in terms of their negative beliefs of being negatively evaluated by others (Foa, Franklin, Perry & Herbert, 1996), whereas a paranoid individual will centre on the theme via persecutory

beliefs, that overestimate both the intensity and probability of the anticipated harm in social contact (Freeman, Garety, Kuipers, Fowler & Bebbington, 2002). Both groups tend to interpret social content in a way that favours their biased beliefs. This reveals the central component of the modern cognitive theory of psychopathology, in which cognitive content is suggested as a vulnerability factor that links specifically with different psychological disorders (Beck, Brown, Steer, Eidelson & Riskind, 1987). However, those with psychological disorders reveal specific interpretation biases that correspond to their disorders (Woud, Zhang, Becker, McNally & Margraf, 2014).

Most literature on interpretation bias in clinical populations focuses on social phobia. We conducted a structured literature search of articles listed in PubMed (NLM), PsycARTICLES (Ovid), PsycINFO (Ovid), and ScienceDirect Journals (Elsevier) published between 1st January 1990 and 1st April 2017. We searched for the terms (interpretation OR interpretation bias) AND (social phobia OR social anxiety OR social anxiety disorder) in April 2017. The titles and abstracts of the corresponding articles were examined for relevance, and our search strategy identified 58 publications. Duplicates were removed, and the abstracts from the remaining 39 publications were screened. Qualitative studies, review articles, dissertation abstracts, case studies, and non-English articles (N = 15) were all excluded. The remaining 24 articles were selected for further screening, and we further articles were excluded for the following reasons: (a) a study did not assess clinically-diagnosed target groups (e.g. existing patients of SAD or patients assessed through clinical interview); (b) studies with a non-adult population; (c) studies not designed to specifically investigate the effect of interpretation bias on target groups, or vice versa; and (e) studies which investigated the effects of interpretations that are likely to target different mechanisms (e.g. interpretation of self-body image). After applying these exclusions, 17 studies satisfied the inclusion criteria.

Research to date has generated a considerable body of evidence for the role of biased interpretation in maintaining social phobia. One mostly consistent conclusion was that individuals with social phobia tend to display content specific (negative) biases in their interpretations of ambiguous scenarios (Amin, Foa & Coles, 1998 & Coles, 1998; Amir, Prouvost & Kuckertz, 2012 2012; Stopa & Clark, 2000) and ambiguous emotional facial

expressions (Garner, Baldwin, Bradley & Mogg, 2009; Maoz et al., 2016) when various alternative interpretations were provided, which means that they may lack the ability to learn non-threat (or positive) interpretations of ambiguous scenarios (e.g. Beard & Przeworski, 2005). Not exclusive to ambiguous information, Voncken, Bogels, and de Vries (2003) demonstrated same content specific interpretation also occurred in positive and negative social scenarios, in which developmental experiences were found to influence how these individuals biased their interpretations (Taylor & Alden, 2005). However, findings against these conclusions are also present, for example Hirsch and Mathews (2000) were unable to identify biases in GSPs towards negative interpretations, while a study by Jusyte and Schonenberg (2014) did not indicate that social phobia is associated with a biased interpretation of ambiguous facial expressions. Nevertheless, most literature to date provides conclusive evidence for a content specific (e.g. social threat versus non-social threat) interpretation within social phobia, and lays the ground work for targeting this specific bias using established CBM techniques (Penton-Voak et al., 2013; Stoddard et al., 2016). For example, a recent RCT study by Amir and Taylor (2012) revealed initial support for the efficacy of interpretation training procedures by significantly decreased threat interpretations and increased benign interpretations in individuals diagnosed with social phobia, which was later confirmed by Brettschneider, Neumann, Berger, Renneberg, and Boettcher (2015). Their results promised a beneficial effect of the interpretation bias modification for social phobia patients, and the programme proved to be feasible and acceptable.

A much smaller body of work on psychosis provides tentative evidence of interpretation bias of ambiguous information. A consensus appears to not yet have been reached regarding the language used for interpretation bias within psychosis studies, leading to the disparate use of terms, such as jumping to conclusion data-gathering/reasoning bias (Startup, Freeman & Garety, 2007 2008), and attribution bias (An et al., 2010). We have attempted to capture the many ways the term has been applied, and via structured review, the titles and abstracts of the corresponding articles were examined for relevance. Relevant articles were identified through literature searches of PubMed (NLM), PsycARTICLES (Ovid), PsycINFO (Ovid), and ScienceDirect Journals (Elsevier) for article published between 1st January 1990 and 1st April, 2017, using the keywords: (interpretation OR interpretation bias OR jumping to

conclusion OR attribution) AND (psychosis OR paranoid psychosis OR schizophrenia OR paranoid schizophrenia OR persecutory delusion OR paranoid delusion OR auditory hallucinations) in April 2017. Our search strategy identified 72 publications, and after removing duplicates the abstracts from the remaining 59 publications were screened. Qualitative studies, review articles, dissertation abstracts, case studies, and non-English articles (N = 15) were excluded. The remaining 40 articles were selected for further screening, and articles were excluded for the following reasons: (a) a study did not assess clinically-diagnosed target groups (e.g. existing patients of psychosis or patients assessed through clinical interview); (b) studies on non-adult populations; (c) studies not designed to specifically investigate the effect of interpretation bias on target groups, or vice versa; and (e) studies which investigated the effects of interpretations that are likely to target different mechanisms. After applying these exclusions 15 studies were found to satisfy the inclusion criteria.

Relevant research to date has primarily focused on patients' interpretation of abnormal experiences and associated emotions, and discussions of interpretation in psychosis have largely been developed from the clinical literature. The results suggest that individuals with psychosis reported more auditory hallucinations (Morrison & Baker, 2000), as well as more negative interpretations of their abnormal experiences than non-patient controls (Morrison, Nothard, Bowe & Wells, 2004). These negative interpretations were associated with perceived distress (Vaughan & Fowler, 2004); however, this may not alter even as the frequency and severity of abnormal experiences decreases (Csipke & Kinderman, 2006). There were also positive interpretations of abnormal experiences in response to auditory hallucinations (e.g. Hayward & Drinnan, 2009), for example patients may feel they are accompanied by the voices they hear (Jenner, Rutten, Beuckens, Boonstra & Sytema, 2008). However, it is clear that negative interpretations elicit fear and resistance to abnormal experiences and are thus appropriate targets for intervention.

Further to the clinical literature there are emerging reports of experimental research adapting cognitive experimental methods from affective disorders which are advancing our understanding of interpretation processes within psychosis. One key finding to emerge is that individuals with psychosis appear to make decisions on the basis of less evidence than

healthy people (Dudley, Taylor, Wickham & Hutton, 2016; So, Siu, Wong, Chan & Garety, 2016), and are less able to integrate disconfirming evidence (Eisenacher et al., 2016; Juarez-Ramos et al., 2014). This interpretation style has been referred to as the jumping to conclusion bias (Ellett, Freeman & Garety, 2008 2008; Garety et al., 2005; Startup et al., 2007 2008) and has been most commonly tested using a beads task (Garety & Freeman, 1999), in which participants are asked to decide from which jar beads are being drawn. Making a decision on the basis of far fewer beads is usually taken to indicate the presence of a marked jumping to conclusion bias. However, this probabilistic reasoning beads task was not designed to determine the content of interpretation and whether it is specific to people with psychosis. One other key finding of interpretation style in individuals with psychosis is concerned with the causal interpretations that individuals give for their own behaviour and the behaviour of others, namely attribution bias (Kinderman & Bentall, 1996). These studies suggest that paranoid patients tend to show a defensive attributional model of persecutory delusions, and choose external attributions that locate blame to other individuals (e.g. (Kinderman & Bentall, 2000; Pinkham, Harvey & Penn, 2016)). This bias appears only in patients and not healthy individuals (Janssen et al., 2006), and may have evolved prior to the onset of psychosis (An et al., 2010). However, this concept goes beyond what interpretation bias is concerned about, as it focuses on the casual directions of existing positive or negative interpretations, rather than the tendency to interpret ambiguous information.

Another group of research studies on paranoid psychosis concerned with interpretation bias have tested interpretations of photographs of people's faces (e.g. positive/negative/neutral facial expressions) and paired verbal messages (e.g. You are so much fun - positive, You are disgusting - negative, Where is the Opera House? - neutral). The findings suggest in paranoid psychosis a way of interpreting communications with negative verbal content (e.g. Penn et al., 2000), when compared to depression patients and healthy controls (Davis & Stewart, 2001). However, whether this interpretation style is specific to paranoid psychosis is not yet clear. A recent study by Savulich, Freeman, Shergill and Yiend (2015) has addressed questions of content-specificity further through an experimental study of subclinical paranoid individuals. They found that high paranoid participants were negatively biased in their

interpretations of ambiguous information when compared to low paranoid participants, and this effect was most pronounced for information directly related to paranoid concerns. However, the results from a subclinical sample limit the implication for clinical pathology, and interpretation biases need to be tested across disorders in order to clarify the content-specificity.

Research on interpretation bias across disorders generally proposes that different types of interpretation bias may be specific to each individual disorder, and concerns have been raised as to whether biased interpretations of social information represent a feature of general psychopathology. Wilson and Rapee (2005) compared individuals with social phobia and comorbid depression, and individuals with social phobia alone to elucidate the specific types of consequences that people with social phobia attach to negative social scenarios. They found depressive symptoms in socially anxious individuals increased interpretation biases in negative social situations. However, the results from this group setting were not able to ascertain if differences in the interpretation were primarily due to social anxiety, depression, or both; therefore, no content specific conclusions could be drawn. To test the content specificity of interpretation bias Voncken, Bogels, and Peeters (2007) used the Interpretation and Judgmental Questionnaire (IJQ) (Voncken et al., 2003) to assess interpretation bias (using open-ended responses and forced-interpretations) in both social and non-social situations with a social phobia comorbid group, depression group and controls. The IJQ allowed participants to rank interpretations of hypothetical scenarios from negative to positive, and the results suggested that content-specific biases for social situations distinguished social phobic patients from depression patients. Social phobia was related to biases specifically related to social situations but not for non-social situations, while depressive symptoms were related to general biases, and were present in both social and non-social situations. However, the social phobia group in this study had no formal DSM IV diagnosis, which limited the validity of these findings in generating clinical implications. In addition, the lack of a comparison with a general anxiety disorder group limited the conclusions regarding the content specificity of this study, as we do not know if social content specific concern was exclusive to social phobic patients or to patients with general anxiety disorders. Laposa, Cassin, and Rector (2010) extended this design by including

groups of clinical patients with social phobia, general anxiety disorder, panic disorder, and obsessive-compulsive disorder. The results indicated that individuals with social phobia generated more negative interpretations than those with other disorders, which suggests that negative interpretations of positive events is a distinct and characteristic feature of social phobia. However, the small sample size limits the power of the results, and including only positive social events without neutral or ambiguous stimuli when testing interpretation bias may imply comorbidity with cognitive factors, such as perfectionism, rather than social phobia itself.

The findings discussed above support the argument that interpretation bias plays an important role in the maintenance of social phobia and psychosis. However, to the best of our knowledge no literature to date has targeted interpretation bias related to content specificity in social phobia versus paranoid psychosis. Reviews of other studies reveal they have yet to adequately investigate whether content specific interpretation bias is represented in clinical social anxiety and psychosis groups, especially via a direct comparison of these groups. This highlights the need for further research using clinical samples, and raises the question of whether or not people with different diagnoses anticipate interpretation bias differently. The present study was designed to evaluate whether different clinical groups and healthy controls represent distinct interpretation bias that is specific to their symptoms. Three cognitive paradigms of Experiment 1: the SRT, the SST (Husstedt et al., 2002), and the WSAP, were used to test interpretation bias scores in four groups of participants: paranoid psychosis, non-paranoid psychosis, social phobia, and healthy controls. For example, participants with paranoid psychosis are expected to be more likely to interpret a stranger standing across the street as a stranger is stalking me than the other groups, while participants with social anxiety are expected to be more likely to interpret a stranger standing across the street as a stranger is laughing at me than the other groups. Group comparison analyses are used to address the following issues.

Firstly, whether all the patient groups (see Table 6.1) are more biased in their interpretations of emotionally ambiguous information than the controls:

- I. The paranoid patient group will show more persecutory interpretation bias than the healthy control group.
- II. The social phobia patient group will show more negative interpretation bias than the healthy control group.

Secondly, whether there is content-specific interpretation of emotionally ambiguous information within the paranoid psychosis patient group and the social phobia patient group. Demonstrating content specificity, as defined in the previous literature, requires evidence of a stronger bias on matching content than non-matching content in the target group. This finding is taken as the necessary and sufficient condition to provide evidence of content specific biased processing.

- III. The paranoid psychosis patient group will show more persecutory bias than negative bias.
- IV. The social phobia patient group will show more negative bias than persecutory bias.

The main hypothesis of this thesis is whether interpretations of emotionally ambiguous information can distinguish different clinical groups through biases that match to their pathology. The presence of a comparator group, e.g. other patients in which the reverse pattern of content specificity is found (i.e. a double dissociation), enables even stronger evidence of the importance of content specific biased processing to be generated. However, it should be noted that the absence of a double dissociation would not normally be taken to imply the presence or absence of a content specific effect within a target group. Consequently, two discrete but similar hypotheses have been developed as we have separated the content specific effects from the presence/absence of these effects in other groups as follows:

- V. The paranoid patient group will show more persecutory interpretation bias than the social anxiety patient group.
- VI. The paranoid patient group will show more persecutory interpretation bias than the non-paranoid patient group.
- VII. The social phobia group will show more negative interpretation bias than the paranoid patient group.

6.3 Methods

6.3.1 Experiment Design

This experiment is based on a cross-sectional design. For the control group, prospective participants were screened by email/phone using a screening questionnaire with demographics questions to determine preliminary eligibility. Eligible participants were then invited to the IoPPN for the experimental session. Paranoid psychosis patients and non-paranoid psychosis patients were interviewed by the PANSS at the beginning of the experiment session to confirm their eligibility, while social phobia patients were screened by phone using a screening questionnaire to determine their preliminary eligibility. Eligible participants were then invited to the session and interviewed by the SCID at the beginning of the experiment session to confirm their eligibility. Eligible patients were invited to continue the experiment session, and were asked to complete baseline measures, before three cognitive experimental tasks (SST, the Scrambled Sentences Task; SRT, the Similarity Rating Task and WSAP, the Word-Sentence Association Task).

Power calculations were conducted using G*Power 3.0.8 (Faul et al., 2007). Data selected from Experiment 1 with two highly vulnerable groups for social anxiety and paranoia indicated that a minimum sample size of 20 per group would be required to detect a significant difference with an effect size of $d=1.17$ on the composites of social anxiety related interpretation bias between groups with 80% power (alpha level 0.05, 2 tailed test). Therefore, 25 participants were recruited for each group in case data from an individual subject cannot be used.

6.3.2 Participants

Four groups ($n=102$) of participants were included in the current experiment based on diagnostic screening: (1) individuals meeting criteria for paranoid psychosis according to DSM-IV (PA; $n=25$), response rate (completed experiment/confirmed appointment) 25/27 (93.59%); (2) individuals meeting the criteria for non-paranoid psychosis according to DSM-IV (NPA; $n=23$), response rate 23/29 (79.31%); (3) individuals meeting the criteria for current social phobia according to DSM-IV (SAD; $n=25$), response rate 25/107 (23.36%); and (4) healthy control group (HC; $n=29$) which did not meet any criteria of the DSM-IV

based on the SCID screening questionnaire, response rate 29/75 (38.67%). Participants were predominantly Caucasian (n=51), with the sample also consisting of Asian (n=10), Black/African/Caribbean (n = 36), and other (n =4) backgrounds. Ages ranged from 18 to 60 years (M = 36.33, SD = 10.84).

6.3.3 Recruitment

The NHS Health Research Authority and Research Ethics Committee approved the study (REC reference: 14/LO/0772), and recruitment commenced in October 2014 and the study lasted approximately one year. All participants had to have normal, or corrected to normal vision, in order to perform the computer tasks, were fluent English speakers, and aged between 18 and 65. Recruitment of the four groups was approached differently according to established recruitment routes. The paranoid/non-paranoid psychosis patient sample was recruited from the South London and Maudsley Trust, including patients attending the Bethlem Psychosis clinic, under the care of consultant psychiatrist Dr Sukhwinder Shergill, the lead clinician at the clinic and collaborator on this project. A full time dedicated research nurse initially screened, recruited, and scheduled the participant of the psychosis patient sample. The doctoral candidate researcher then interviewed (with PANSS and demography questionnaire) and tested (baseline measures and tasks) the patients in dedicated lab space on the 6th floor of the Institute of Psychiatry. The social phobia patient sample was recruited from local GPs, Southdown Housing Association, and self-help groups, including Social Anxiety UK, SASH, and Anxiety UK. The doctoral candidate researcher (trained and approved by a dedicated psychologist) initially screened (via a screening questionnaire and demographics questionnaire), recruited, and scheduled the participants for the social phobia patient sample. The chief investigator then interviewed (using SCID) and tested (baseline measures and tasks) the patients in a dedicated lab space on the 6th floor of the Institute of Psychiatry and at the Southdown Housing Association. The healthy controls sample was recruited from KCL via internal circular emails and posters displayed on local public notice boards. The chief investigator initially screened (via the SCID screening questionnaire and a demographics questionnaire), recruited, and scheduled the participants for the healthy control sample. The chief investigator tested (baseline measures and tasks) the participants in a dedicated lab space on the 6th floor of the Institute of Psychiatry. The inclusion and

exclusion criteria are listed in Table 6.1.

Table 6.1: Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
Paranoid psychosis (n=25)	
<ul style="list-style-type: none"> • current diagnosis of schizophrenia with significant symptoms of paranoia • symptomatically stable with mild to moderate positive symptoms • not currently in an acute psychotic state, and prescribed medication but without a change in dose in the last 3 months • stable on medication for at least last 3 months and expected to remain for study duration 	<ul style="list-style-type: none"> • having received a psychological intervention targeting cognitive biases within the last 3 months or currently receiving, or expected to receive during the study period • current significant psychiatric comorbidity including: social phobia, significant (current) use of alcohol or substances, bipolar affective disorder, depression, and personality disorder
Non-Paranoid psychosis (n=23)	
<ul style="list-style-type: none"> • current diagnosis of schizophrenia but without significant symptoms of paranoia • symptomatically stable with mild to moderate positive symptoms • not currently in an acute psychotic state, and prescribed medication but without a change in dose in the last 3 months • stable on medication for at least last 3 months and expected to remain for study duration 	<ul style="list-style-type: none"> • having received a psychological intervention targeting cognitive biases within the last 3 months or currently receiving, or expected to receive during the study period • current significant psychiatric comorbidity including: social phobia, significant (current) use of alcohol or substances, bipolar affective disorder, depression, and personality disorder
Social phobia (n=25)	
<ul style="list-style-type: none"> • stable on medication for at least last 3 months and expected to remain for study duration • meeting criteria for current social phobia according to DSM-IV TR 	<ul style="list-style-type: none"> • having received a psychological intervention targeting cognitive biases within the last 3 months, or currently receiving, or expected to receive during the study period • current significant psychiatric comorbidity including: psychotic disorders, significant (current) use of alcohol or substances, bipolar affective disorder, and personality disorder
Healthy control group (n=29)	
<ul style="list-style-type: none"> • screening negative for all axis 1 and 2 disorders 	<ul style="list-style-type: none"> • previously diagnosed with psychological or psychiatric problem(s), or currently receiving treatment for psychological or psychiatric problem(s) • taking any psychological or psychiatric medication (this does not include medications for general health concerns).

N.B. Paranoid/non-paranoid psychosis patients were screened via PANSS and demographics questionnaires; social phobia patients and healthy controls were screened via SCID and demographics questionnaires.

6.3.4 Materials

6.3.4.1 Screening Questionnaires

Healthy controls version

A screening questionnaire was sent by email to each participant of the healthy control group at the recruitment stage to check their eligibility. Participants were asked to answer questions using YES or NO to indicate their personal information (e.g. are you currently diagnosed with social anxiety disorder/social phobia? Or have you ever been diagnosed in the past?).

Social phobia patients' version

A screening questionnaire was completed by phone for each participant of the social phobia group at the recruitment stage to check their eligibility. Participants were asked to answer questions using YES or NO to indicate their personal information (e.g. have you ever been diagnosed with any mental health problems?). Ethnicity categorisation was provided asked at the end of the screening questionnaire.

6.3.4.2 Clinical interviews

Structured Clinical Interview for DSM-IV-TR Axis I Disorders, Research Version, Patient Edition (SCID-I/P) (First, Spitzer, Gibbon & Williams, 2002)

This is a semi structured interview for making major DSM-IV Axis I diagnoses (e.g. SAD). The social phobia group were interviewed using the SCID at the beginning of the experiment session to confirm their eligibility. The SCID is broken down into separate modules allow an administrator to 'skip' the associated questions if not met. For all diagnoses symptoms are coded as 1 (absent), 2 (sub-threshold) or 3 (threshold). Questions may necessitate further exploration by the interviewer in order to score a particular item. If a threshold is reached on a sufficient number of items, that category of disorder is deemed to be present. The instrument demonstrates acceptable test-retest ($k=0.68$) and interrater reliability ($k=0.71$) and takes up to 1 hour to administer. This study adopted the research version non-patient edition of the SCID because this contains most of the information that is diagnostically useful to researchers, including disorders, subtypes, severity and course specifiers, and provisions

for coding the specific details of past mood episodes. The SCID-I/P (Patient Edition) is designed for use with subjects who are identified as psychiatric patients; in this study identified as social phobia patients.

Positive and Negative Syndrome Scale (PANSS) (Kay, Fiszbein & Opler, 1987)

This is one of the most widely used measures of psychopathology of schizophrenia within clinical research. Since its development the PANSS has become a benchmark when screening and assessing change, in both clinical and research patients. It consists of a 30-item scale which is used to evaluate the presence, absence and severity of positive, negative and general psychopathology symptoms of schizophrenia. The 30 items are arranged as seven positive symptom subscale items, seven negative symptom subscale items, and 16 general psychopathology symptom items. Each item has a definition and a basis for rating, and all 30 items are rated on a 7-point scale (1 = absent; 7 = extreme). The strengths of the PANSS include its structured interview, robust factor dimensions, reliability, the availability of detailed anchor points, and validity. It requires 45 to 50 minutes to administer

The paranoid psychosis group and non-paranoid psychosis group were interviewed using the PANSS at the beginning of the experiment session. Both groups of psychosis patients were clinically diagnosed before being recruited to this study, although their PANSS scores were available in their medical history, our interview was to re-assure the presence and severity of paranoid symptoms, and group allocation. This study categorised the paranoid or non-paranoid psychosis patient groups based on P6 scores, the suspiciousness/persecution item of PANSS. This uses a scale of 1=absent, 2=minimal, may be at upper extreme of normal limits, and 3=mildly symptomatic, to measures unrealistic or exaggerated ideas of persecution. Scores for this study on item P6 ranged from 1 to 6 within the entire sample: 1 (13.73%), 2 (12.75%), 3 (8.82%), 4 (4.9%), 5 (3.92%), and 6 (2.94%). According to the definition employed by the PANSS (Kay et al., 1987), that paranoid symptoms are present for scores of 3 or higher, and paranoid symptoms are absent or 'normal' for scores of 2 or lower, patients scoring 3 or higher were allocated to the paranoid group, which included the entire range from mild (e.g. scoring 3) to severe paranoid (e.g. scoring 6) patients. Patients

scoring 2 or less were allocated to the non-paranoid group, which included patients with absent or normal paranoia. This group classification was consistent with that of a previous study (Savulich, Shergill & Yiend, in press) which investigated interpretation bias in same group setting. In this study we refer to the groups as 'paranoid' (rather than 'high paranoid') and 'non-paranoid', which most accurately reflects the actual distinction between the groups as currently defined, i.e. as paranoid symptoms present and paranoid symptoms absent or 'normal'.

6.3.4.3 Measurement of Emotional Trait

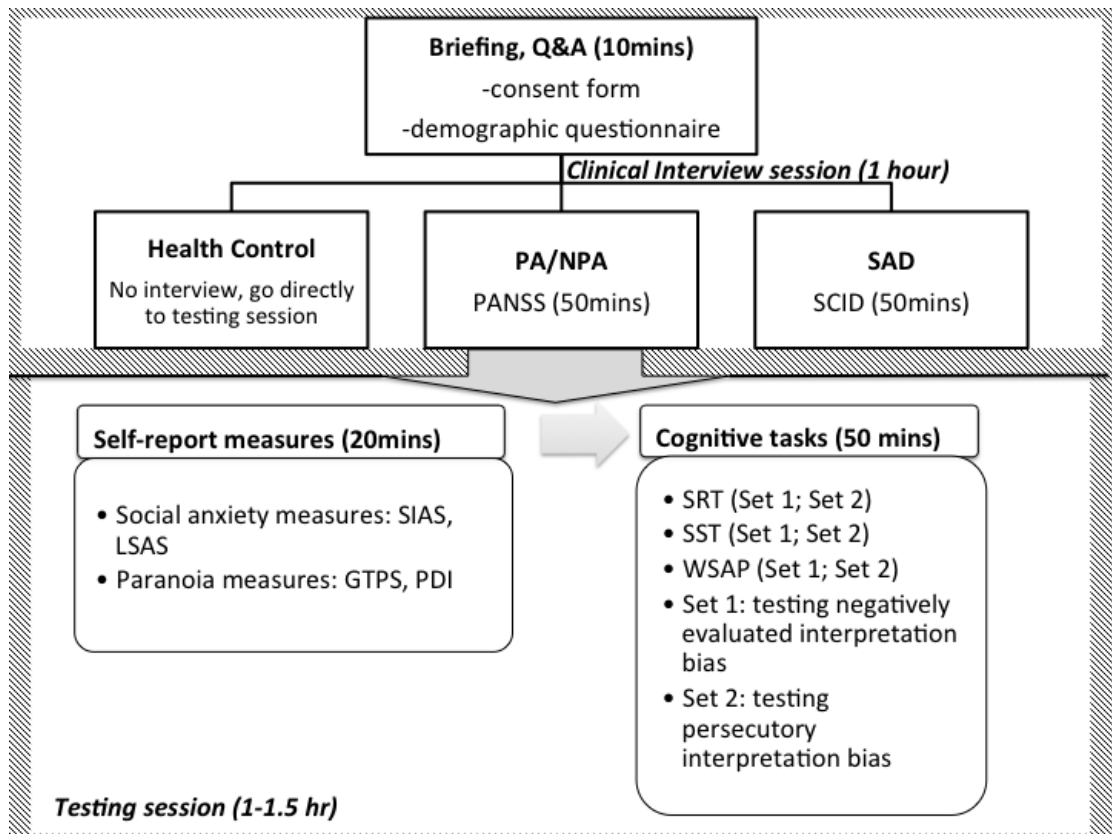
We selected two social anxiety measures (Social Interaction Anxiety Scale, SIAS; Liebowitz Social Anxiety Scale, LSAS) and two paranoia measures (Green et al. Paranoid Thought Scales, GPTS; Peters Delusions Inventory, PDI) from the previous experiment, as these measures are the most sensitive for a clinical population, and are suitable in length for clinical patients. The three cognitive tasks testing interpretation bias were: the SST, SRT, WSAP (see section 2.3.3 for a detailed description) were adopted to enable results consistency.

6.3.5 Procedure

The clinical interviews for the patient groups lasted up to 1 hour, and the testing session lasted around one to one and half hours and varied across individuals. Thus, the whole experiment session lasted 2 to 2 and half hours for the three patient groups, and 1 to 1 and half hour for the healthy control group. All the participants were informed of the inclusion criteria again before starting the session. As shown in Figure 6.1, they were then asked to complete the consent form and the demographics questionnaire, followed by self-reported measures; this took approximately 20-30 minutes. Finally, to measure interpretation biases representing negative interpretation (social anxiety related) and persecutory interpretation (paranoia related), three cognitive experimental tasks were used, each containing two sets of materials reflecting both types of content. Two parallel versions of each task were developed and used in a counterbalanced order across the participants. All baseline measures were presented to participants ahead of the interpretation tasks. Self-reported measures and tasks were presented in two counterbalanced, fixed orders across

participants. A counterbalanced design reduces the chances of order effects which measure/task or other factors adversely influence the results.

Figure 6.1: Experimental procedure



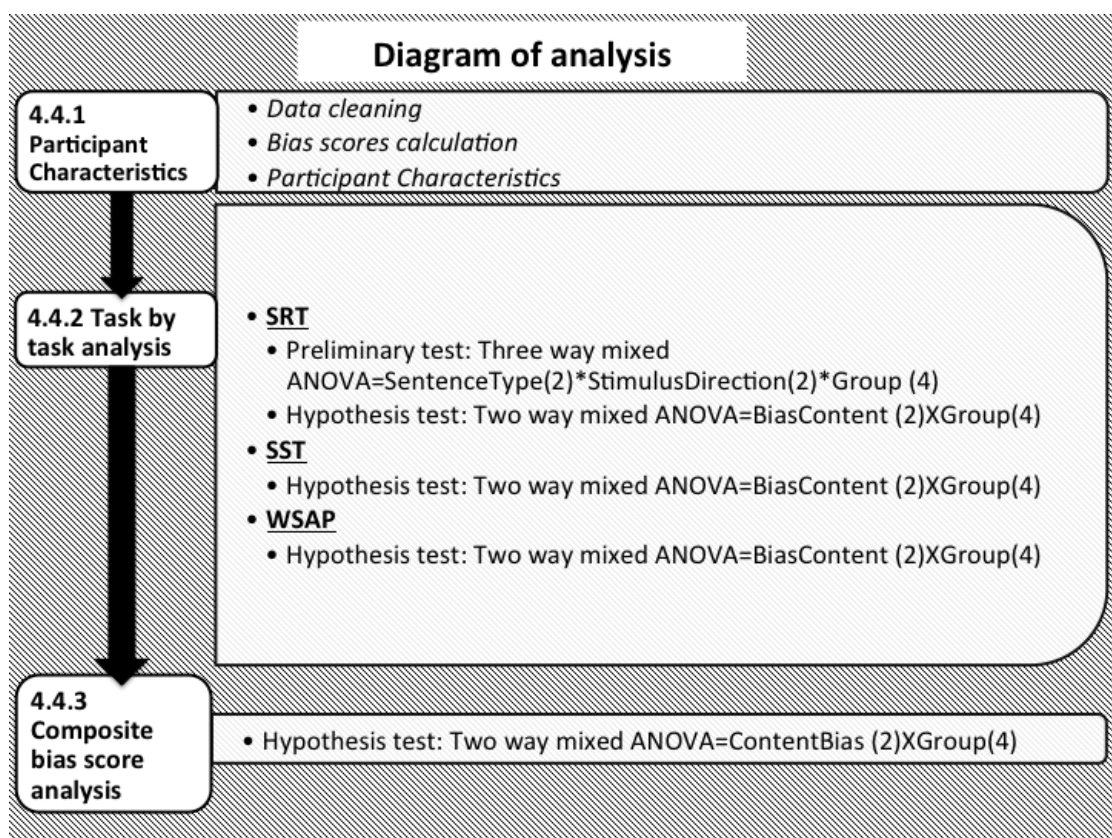
Note: All measures were presented to participants ahead of the interpretation tasks. Self-reported measures and tasks were presented in two counterbalanced, fixed orders across participants. PA= paranoid psychosis; NPA=non-paranoid psychosis; SA=social phobia; HC=healthy controls; SCID= The Structured Clinical Interview for DSM–IV Personality Disorders (SCID) (First et al., 2002); PANSS=The Positive and Negative Syndrome Scale (PANSS) (Kay et al., 1987); LSAS: Liebowitz Social Anxiety Scale (Liebowitz, 1987); SIAS: Social Interaction Anxiety Scale (Mattick & Clarke, 1998); GTPS: Green et al. Paranoid Thought Scales (Green et al., 2008); PDI: Peters Delusions Inventory (PDI; Peters et al., 1999). SRT: Similarity Ratings Task (SRT, Based on Eysenck et al. 1991); SST: Scrambled Sentences Task (SST; based on Wenzlaff & Bates, 1998); WSAP: The word-sentence association paradigm (WSAP, based on (Beard & Amir, 2009).

6.3.6 Design of Analysis

This experiment used a cross-sectional design and four groups of participants were tested for emotional trait measures and cognitive tasks. Our key concerns when conducting the analyses included the group differences of participants' ratings on three cognitive tasks measuring interpretation bias.

To form a rational approach, we firstly analysed the raw data task by task to determine the preliminary results of each pen and paper/ computer-based task. Next we calculated the composite scores based on the raw data to test our hypothesis more directly. The reason for using composite scores in this analysis is to achieve the clarity that analysis based on composite trait scores gives, and in addition composite bias scores are able to more obviously map our hypothesis. Composite scores provide convergent validity for the construct measured by including several measures of the same phenomenon and a mixed design ANOVA was therefore used to conduct the analysis.

Figure 6.2: Diagram of analysis



Note: SRT: Similarity Ratings Task (SRT, Based on Eysenck et al. 1991); SST: Scrambled Sentences Task (SST; Based on Wenzlaff & Bates, 1998); WSAP: The word-sentence association paradigm (WSAP, Based on Beard & Amir, 2010(Beard & Amir, 2009)); Contentrawscore=negative/persecutory rating score on interpretation bias; sentencetype=foil/target sentence in SRT; direction=benign/threat meaning of interpretation in SRT; contentbias=calculated negative/persecutory interpretation bias scores. Composite=mean of standardized bias scores of SRT, SST and WSAP; group= paranoid psychosis (PA), non-paranoid psychosis (NPA), social phobia (SAD), health control (HC).

As shown in Figure 6.2, in order to conduct the task-by-task analysis different mixed design ANOVAs were performed using the ratings scores as within group variables, and group

(paranoid psychosis, non-paranoid psychosis, social phobia, healthy control) as the between group variable. A T-test was conducted following the ANOVA if there was a within group interaction; a paired-sample T-test was used to check bias differences within a group, and an independent-sample T-test was used to check group differences for specific biases.

To test our hypothesis directly, composites were calculated for social anxiety/paranoia measures, and for social anxiety/paranoia related bias. We generated the composites by standardising ($M = 0$, $SD = 1$) participants' scores for each measure and task, and then averaging across them separately. These represent the social anxiety trait, paranoia trait, social anxiety related interpretation bias, and paranoia related interpretation bias, separately. Using the composites we then undertook a two-way mixed design ANOVA followed by a T-test for the analysis of within group interactions.

6.4 Results

6.4.1 Participant Characteristics

6.4.1.1 Data Cleaning

Preliminary analyses were conducted to ensure there were no violations of the assumptions of normality, linearity, and homoscedasticity. We have not filtered any scores from our data except the reaction time data of the WSAP. To remove the influence of spuriously long response times, data was excluded from trials with reaction times shorter than 50 ms or longer than 1500 ms. This time limitation was set following the design of original WSAP by Beard and Amir (2009); this resulted in the elimination of 4.38% of trials. There were 57 missing data points, which were treated by pairwise deletions. The inspection of missing data did not suggest any systematic problems with the measurement tools or methods, and missing data appeared to be randomly distributed.

6.4.1.2 Bias Scores Calculation

In order to compare the reaction times or rating indices with the self-reported indices, we calculated bias scores for the social scenario sentences. Bias scores from each task were calculated using the equations listed in Table 6.2. We calculated two bias scores for each task, which reflected the negatively evaluated bias and persecutory bias.

Table 6.2: Bias score equations

Task name	Bias score	Equations	Range of values
SST	Negative bias	Interpretation Bias = (Social anxiety statements/All statements completed)*100 %	0, 100
	Persecutory bias	Interpretation Bias = (Paranoia statements/All statements completed)*100 %	0, 100
SRT	Negative bias	Interpretation Bias = Mean of ratings on all Target Social anxiety - Mean of ratings on all Target Benign	-3, 3
	Persecutory bias	Interpretation Bias = Mean of ratings on all Target Paranoia -Mean of ratings on all Target Benign	-3, 3
WSAP	Negative bias	Interpretation Bias = Reaction times (Social anxiety meaning reject - Social anxiety meaning endorse)	-1500, 1500
	Persecutory bias	Interpretation Bias = reaction times (Paranoia meaning reject -Paranoia meaning endorse)	-1500, 1500

Note: negative bias represents social anxiety related interpretation; persecutory bias represents social anxiety related interpretation.

6.4.1.3 Participant Characteristics

Scores of 2 for the self-reported measures of LSAS and SIAS reflect the emotional traits of social anxiety, while scores of 2 for the self-reported measures of G-PTS and PDI reflect the emotional traits of paranoia. Scores of 3 for the cognitive tasks WSAT, SST and SRT represent the interpretation bias in both reaction time self-rating conditions. Means and standard deviations for each measure are presented in Table 6.3.

Table 6.3: Participants' characteristics

	Paranoid Psychosis	Non-Paranoid Psychosis	Social Phobia	Healthy Controls
N	25	23	25	29
Age	43.12(7.98)	42.22(8.24)	31.49(10.28)	30.07(9.65)
Gender (N)	M=20 F=5	M=18 F=5	M=12 F=13	M=8 F=21
PANSS	83.60(16.82)	50.65 (10.96)		
PANSS P6	3.72 (1.28)	1.39 (0.50)		
GTPS	39.56(15.89)	27.68(9.86)	32.32(14.41)	20.69 (5.26)
PDI Total	125.88(42.74)	44.47(24.10)	61.48(43.01)	29.66(34.92)
SIAS	53.60(31.06)	44.78(25.71)	84.52(26.71)	27.83(16.74)
LIAS	79.36(34.39)	53.11(17.97)	56.96(23.73)	39.31(9.20)

Note: Mean values (std dev) presented, n=84. LSAS: Liebowitz Social Anxiety Scale (Liebowitz, 1987); SIAS: Social Interaction Anxiety Scale (Mattick & Clarke, 1998); GTPS: Green et al. Paranoid Thought Scales (Green et al., 2008); PDI: Peters Delusions Inventory (PDI; Peters et al., 1999). SRT: Similarity Ratings Task (SRT, Based on Eysenck et al. 1991); SST: Scrambled Sentences Task (SST; Based on Wenzlaff & Bates, 1998); WSAP: The word-sentence association paradigm (WSAP, Based on Beard & Amir, 2010).

6.4.2 Task by Task analysis

Task by task analysis was conducted by comparing the four groups of participants on their scores for the three cognitive tasks. Individual interpretation bias scores were analysed task by task using a mixed design ANOVA and a follow-up T-test in order to interpret significant interactions between groups, and to investigate group differences in participants' interpretation bias.

6.4.2.1 Similarity Rating Task

Preliminary analysis with mean rating score of participants

A four-way mixed design ANOVA was conducted on the mean similarity ratings, with factors Content (social anxiety, paranoia) x Sentence Type (target, foil) x Stimulus Direction (pathological congruent, benign) x Group (paranoid patient, non-paranoid patient, social phobia patient, control). This revealed a significant four-way interaction, $F(3, 97) = 18.56$, $p < 0.0001$, partial $\eta^2 = 0.37$, $\epsilon = 1$ with main effects of Content, $F(3, 97) = 12.17$, $p < 0.0001$, $\eta^2 = 0.27$, $\epsilon = 1$ Sentence Type, $F(1, 97) = 230.15$, $p < 0.0001$, $\eta^2 = 0.70$, $\epsilon = 1$ and Stimulus Direction, $F(1, 97) = 104.85$, $p < 0.0001$, $\eta^2 = 0.52$, $\epsilon = 1$. The Sentence Type main effect reflected the endorsement of target sentences as more similar in meaning to the

original passages than foil sentences ($M = 2.26$, $SD = 0.49$ vs. $M = 1.78$, $SD = .47$), as might be expected and is commonly found on this task. Mean participant ratings and standard deviations of each sentence type (targets and foils) for paranoia relevant and social anxiety relevant items are indicated in Table 6.4.

To interpret this four-way interaction, follow up mixed ANOVAs (Sentence Type x Stimulus Direction x Group) were conducted for each type of content separately (paranoid, socially anxious).

Paranoid content:

For paranoid items the corresponding three-way interaction was significant, $F(3,98) = 23.37$, $p < 0.0001$, $\eta^2 = 0.42$, $\epsilon = 1$. To interpret this we conducted separate two-way ANOVAs (Stimulus Direction x Group) for each Sentence Type (target, foil) on paranoid items only, in line with previous studies (Yiend et al., 2011; Yiend et al., 2005; (Savulich et al., 2015)). These revealed a significant Stimulus Direction x Group interaction for paranoid targets, $F(3,98) = 10.78$, $p < 0.0001$, $\eta^2 = 0.25$, $\epsilon = 1$, but not foils, $F(3,98) = 2.37$, $p = 0.08$, $\eta^2 = 0.07$, $\epsilon = 1$. The pattern of results for paranoia relevant target items across groups is shown in Figure 6.3. Follow-up independent samples t-tests showed that paranoid groups made significantly more paranoid interpretations compared to controls (paranoid vs. control, $t(52) = 3.15$, $p = 0.003$, $d = 0.39$, 95% CI, 0.14, 0.64, mean = 2.18, $SD = 0.52$ vs. mean = 1.78, $SD = 0.39$), while non-paranoid group (non-paranoid group vs. control, $t(50) = 1.08$, $p = 0.29$, $d = 0.15$, 95% CI, -0.13, 0.44, $\epsilon = 1$, mean = 1.94, $SD = 0.62$ vs. mean = 1.78, $SD = 0.39$), and social anxiety group (social phobia group vs. control, $t(52) = -1.53$, $p = 0.13$, $d = -0.19$, 95% CI, -0.43, 0.06, $\epsilon = 1$, mean = 1.59, $SD = 0.51$ vs. mean = 1.78, $SD = 0.39$) did not. Patient groups did not significantly differ in non-paranoid interpretations compared to controls, (paranoid vs. control, $t(52) = -1.82$, $p = 0.07$, $d = -0.27$, 95% CI, -0.56, 0.03, $\epsilon = 1$, mean = 2.59, $SD = 0.56$ vs. mean = 2.85, $SD = 0.52$; non-paranoid vs. control, $t(50) = -3.55$, $p = 0.001$, $d = -0.52$, 95% CI -0.81, -0.22, $\epsilon = 1$, mean = 2.34, $SD = 0.52$ vs. mean = 2.86, $SD = 0.52$; social phobia vs. control, $t(52) = -2.48$, $p = 0.02$, $d = -0.30$, 95% CI -0.55, -0.05, $\epsilon = 1$, mean = 2.55, $SD = 0.34$ vs. mean = 2.86, $SD = 0.52$).

Table 6.4: Mean similarity ratings for each sentence type on the Similarity Ratings task, bias scores of unscrambled sentences for each content type on the Scrambled Sentences task and the Word-Sentence Association Paradigm task

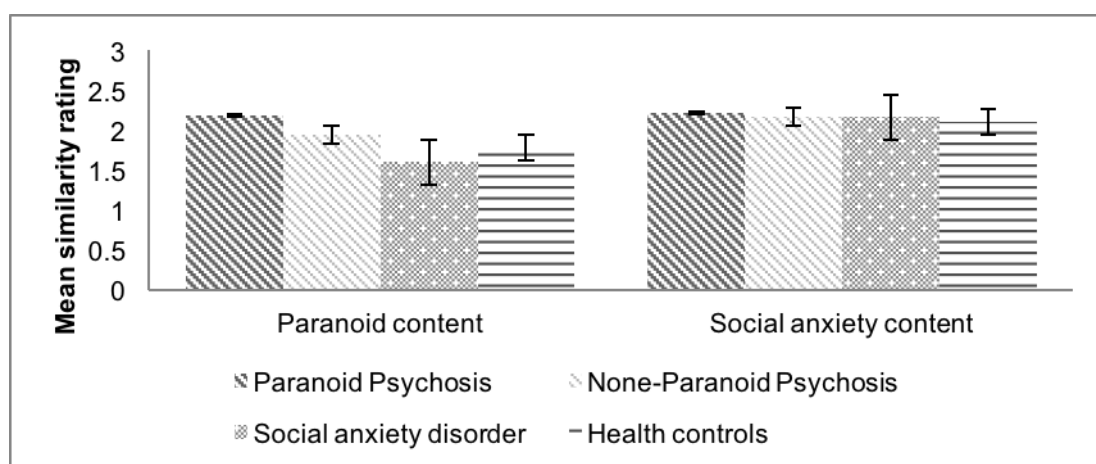
Task	Content	Sentence Type	Direction	Group			
				Paranoid psychosis	Non-paranoid psychosis	Social anxiety	Health controls
SRT	Paranoid	Targets	Threatening	2.17(0.54)	1.94 (0.63)	1.60 (0.51)	1.78 (0.39)
			Benign	2.57(0.46)	2.39 (0.63)	2.55 (0.34)	2.86 (0.52)
		Foils	Threatening	1.92 (0.55)	1.70 (0.68)	1.19 (0.20)	1.17 (0.19)
			Benign	2.27 (0.58)	2.08 (0.68)	1.53 (0.35)	1.32 (0.29)
	Socially anxious	Targets	Threatening	2.26 (0.42)	2.10 (0.46)	2.16 (0.52)	2.10 (0.45)
			Benign	2.70 (0.44)	2.64 (0.56)	2.31 (0.44)	2.60 (0.45)
		Foils	Threatening	2.15 (0.54)	2.04 (0.51)	1.61 (0.44)	1.50 (0.35)
			Benign	2.28 (0.54)	2.50 (0.66)	1.74 (0.38)	1.83 (0.46)
SST	Paranoid			33.96 (22.90)	28.78 (20.56)	39.22 (30.95)	19.69 (19.87)
	Socially anxious			22.42 (24.07)	38.83 (26.12)	42.13 (22.95)	21.03 (13.57)
WSAP	Paranoid			9.31 (149.84)	-1.88 (108.12)	-39.94 (112.71)	-
							36.84 (116.26)
	Socially anxious			23.49 (152.17)	7.47 (115.36)	27.65 (126.90)	-8.90 (105.55)
Composite	Paranoid			0.31 (0.65)	0.21 (0.65)	-0.04 (0.67)	-0.39 (0.64)
	Socially anxious			-0.12 (0.61)	0.15 (0.67)	0.33 (0.79)	-0.24 (0.52)

Note: paranoid content = items showing persecutory content that represented paranoia related meaning; socially anxious content = items showing negatively evaluative content that represented social anxiety related meaning; target sentence: with content, relevant to the previous passage; foil sentence: with content, irrelevant to the previous passage; Threatening direction: persecutory/ negatively evaluated interpretation; benign direction: neutral interpretation.

The paranoid patient group and non-paranoid patient group did not differ significantly from each other in their biased interpretations of paranoia relevant material (on paranoid sentences: paranoid vs non-paranoid patients $t(46) = 1.43$, $p = 0.158$, $d = 0.24$, 95% CI -0.09, 0.57, mean = 2.17, SD = 0.10 vs. mean = 1.93, SD = 0.13); on non-paranoid sentences: paranoid vs non-paranoid patients $t(46) = 1.59$, $p = 0.118$, $d = 0.25$, 95% CI -0.07, 0.56, mean = 2.59, SD = 0.56 vs. mean = 2.34, SD = 0.52).

The paranoid patient group and social anxiety patient group differed significantly from each other in their biased interpretations of paranoid items: paranoid vs social phobia patients $t(48) = 3.99$, $p < 0.0001$, $d = 0.58$, 95% CI 0.29, 0.87, mean = 2.18, SD = 0.52 vs. mean = 1.59, SD = 0.51), but not on non-paranoid items: paranoid vs social phobia patients $t(48) = 0.28$, $p = 0.78$, $d = 0.04$, 95% CI -0.23, 0.29, mean = 2.59, SD = 0.56 vs. mean = 2.56, SD = 0.34).

Figure 6.3: Patterns of interpretation bias on the Similarity Ratings task across groups



Note: Higher ratings reflect more pathological interpretations; pattern of results for target material only. Mean similarity rating indicates relatedness between sentence and passage stimuli, which they can rate from 1, 2, 3, or 4 (1 = very different in meaning, 4 = very similar in meaning), and reflect the significant Stimulus Direction x Group interaction reported in the text.

Figure 6.3 illustrates the findings from this task, reflecting the above two-way interaction ($F = 10.78$, $p < 0.0001$), namely significant group differences in the specific interpretation of ambiguous material (i.e. target items) only when that material content permits interpretations relevant to persecutory thinking (i.e. paranoia relevant content only). These findings

supported hypotheses I and III by revealing a specific bias in the interpretation of ambiguity related to potentially paranoid content in paranoid patients. In contrast, hypothesis VI was not supported as the degree of content specificity did not differ significantly between paranoid and non-paranoid patient groups.

Socially anxious content:

For social anxiety items, the three-way interaction Sentence Type x Stimulus Direction x Group was not significant, $F(3,98) = 1.67$, $p = 0.178$, $\eta^2 = 0.05$, $\epsilon = 1$, while the Stimulus Direction x Group interaction was also not significant, $F(3,98) = 1.73$, $p < 0.165$, $\eta^2 = 0.05$, $\epsilon = 1$. Thus, hypotheses II and IV were not supported by the mean rating scores from participants, as the degree of content specificity did not differ significantly between the social phobia patient group and control group, social phobia patient group and paranoid patient group, social phobia patient group and non-paranoid patient group.

In order to test if there was content-specific interpretation bias in paranoid patients and social phobia patients, we conducted paired-samples t-tests between the persecutory bias scores and negative bias scores for each concerned group separately (paranoid patient group, social phobia patient group). In the paranoid psychosis patient group, paired-sample t-tests showed there was no significant difference between their bias scores when completing persecutory material and negative material. In the social phobia patient group, paired-sample t-tests showed that this group had significantly higher bias scores when completing negative material (mean = -0.14, SD = 0.85) than persecutory material (mean = -0.96, SD = 0.52), $t(25) = -5.57$, $p < 0.0001$. Thus, only hypothesis IV was supported, the social phobia patient group showed significant content-specific interpretation bias.

6.4.2.2 Scrambled Sentence Task

A two-way mixed design ANOVA was conducted on the generated bias scores (bias scores calculated based on equation presented in Table 6.2), with Bias Content (negative, persecutory) x Group (paranoid patient, non-paranoid patient, social phobia patient, control). This revealed a significant two-way interaction, $F(3, 97) = 3.18$, $p = 0.03$, partial $\eta^2 = 0.09$, $\epsilon = 1$, with significant main effects of Bias Content, $F(3, 97) = 5.34$, $p = 0.002$, $\eta^2 = 0.14$, ϵ

= 1. Mean participant bias scores and standard deviations for persecutory (paranoia relevant) and negative (social anxiety relevant) items are indicated in Table 6.4.

To interpret this two-way interaction follow up independent samples t-tests were conducted for each type of bias content separately (persecutory, negative).

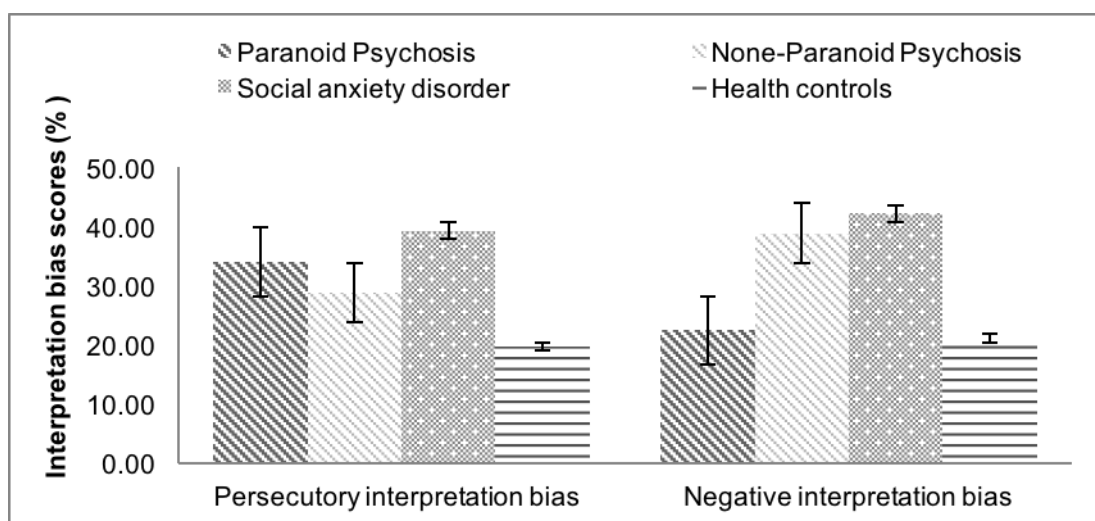
Paranoid content:

Follow-up independent sample t-tests showed that all patient groups had significantly higher persecutory bias scores compared to controls (paranoid vs. control, $t(52) = 1.85$, $p = 0.07$, $d = 0.11$, 95% CI, -0.97, 23.54, $\epsilon = 1$; non-paranoid vs. control, $t(50) = 2.36$, $p = 0.02$, $d = 12.49$, 95% CI, 1.87, 23.12, $\epsilon = 1$; social phobia vs. control, $t(52) = 2.79$, $p = 0.007$, $d = 19.53$, 95% CI, 5.52, 33.55, $\epsilon = 1$). The two psychosis patient groups did not differ significantly from each other in their bias scores of persecutory material, $t(46) = -0.19$, $p = 0.85$, $d = -1.21$, 95% CI 13.89, 11.47, $\epsilon = 1$). Finally, the paranoid psychosis patient group and social phobia patient group also did not differ significantly from each other in their bias scores of persecutory material, $t(48) = -1.04$, $p = 0.11$, $d = -0.825$, 95% CI -24.24, 7.75, $\epsilon = 1$)

Socially anxious content:

Follow-up independent sample t-tests showed that the social phobia patient group had significantly higher negative bias scores compared to controls, (social phobia vs. control, $t(52) = 4.18$, $p = < 0.0001$, $d = 21.09$, 95% CI, 10.96, 31.23, $\epsilon = 1$), while the psychosis groups and control group were not significantly different in their negative bias scores. The difference between the social phobia patient group and paranoid psychosis patient group in their bias scores of socially anxious material reached marginally significance, $t(48) = -1.96$, $p = 0.05$, $d = -13.85$, 95% CI -28.05, 0.35, $\epsilon = 1$.

Figure 6.4: Patterns of interpretation bias on the Scrambled Sentences task across groups



Note: Increased value indicates more biases of interpretation. Interpretation bias scores of SST calculated based on the percentage of unscrambled sentences using equation in Table 6.2, which represented negatively evaluative content (social anxiety related) and persecutory content (paranoia related) separately.

Figure 6.4 illustrates the specific finding from the SST bias scores, reflecting the above two-way interaction ($F(3, 97) = 3.18, p = 0.03$), namely significant group differences in the specific interpretation of ambiguous material, only when that material permits interpretations relevant to symptom congruent thinking (i.e. persecutory content). These findings support hypothesis I by revealing a specific bias in the interpretation of ambiguity related to potentially paranoid content in paranoid patients when compared to the healthy control group, and supported hypotheses II and IV by revealing a specific bias in the interpretation of ambiguity related to potentially socially anxious content in social phobia patients. In contrast, hypothesis VI was not supported as the degree of content specificity did not differ significantly between the two psychosis patient groups. Hypothesis V was also not supported as the degree of content specificity related to potentially paranoid content did not differ significantly between the paranoid psychosis patient group and the social phobia patient group.

In order to test if there was content-specific interpretation bias in paranoid patients and social phobia patients we conducted paired-sample t-tests between persecutory bias scores and negative bias scores for each group separately (paranoid patient group, social phobia patient group). In the paranoid psychosis patient group paired-sample t-tests showed that the group had significantly higher bias scores when completing persecutory material (mean = 33.96, SD = 22.89) than negative material (mean = 22.42, SD = 24.07), $t(25) = -2.18, p = 0.039$. In the social phobia patient group paired-sample t-tests showed that the group did not differ in their bias scores when completing negative material and persecutory material. Thus, only hypothesis III was supported that the paranoid patient group showed a significantly content-specific interpretation bias.

6.4.2.3 Word-Sentence Association Paradigm Task

A two-way mixed design ANOVA was conducted for the generated bias scores (calculated based on equation shown in Table 6.2), for Bias Content (negative, persecutory) x Group (paranoid patient, non-paranoid patient, social phobia patient, control). Mean participant scores and standard deviations of interpretation bias for negative and persecutory content are presented in Table 6.4. No significant main effect of group was observed, suggesting that bias scores of WSAP did not significantly differ between groups, while there was also no significant interaction of bias content.

In order to test if there was content-specific interpretation bias in paranoid patients and social phobia patients we conducted paired-sample t-tests between persecutory bias scores and negative bias scores for each group separately (paranoid patient group, social phobia patient group). In the paranoid psychosis patient group paired-sample t-tests showed that there was no significant difference between their bias scores when completing persecutory material and negative material. In the social phobia patient group paired-sample t-tests

showed that the group had significantly higher bias scores when completing negative material (mean = 27.65, SD = 126.90) compared to persecutory material (mean = -39.94, SD = 112.71), $t(24) = -2.71$, $p = 0.012$). Thus, only hypothesis IV was supported that the social phobia patient group showed a significantly content-specific interpretation bias.

6.4.3 Composite Bias Score Analysis

Design of analysis and data preparation

We calculated the composite scores based on the raw data to test our hypothesis directly. Composite interpretation bias scores were analysed using a two-way mixed design ANOVA and follow-up T-test (interpreting significant interactions between groups) to investigate the group differences in participants' interpretation bias.

Two composite scores represented the social anxiety related bias and the paranoia related bias separately. We generated the composites by standardising ($M = 0$, $SD = 1$) participants' scores for each measure and task, and then averaging across them separately. The social anxiety related bias scores from the SST, SRT and WSAP tasks were averaged to generate a composite score for displayed social anxiety related interpretation bias. The paranoia related bias scores from the SST, the SRT and the WSAP tasks were averaged to generate a composite score for displayed paranoia related interpretation bias (see calculation of bias scores presented in Table 6.2).

A two-way mixed design ANOVA was conducted on bias composites for Bias Content (negative, persecutory) \times Group (paranoid patient, non-paranoid patient, social phobia patient, control). This revealed a significant two-way interaction, $F(3, 98) = 5.87$, $p = 0.001$, partial $\eta^2 = 0.152$, $\epsilon = 1$, with significant main effects of Bias Content, $F(3, 98) = 4.62$, $p = 0.005$, $\eta^2 = 0.124$, $\epsilon = 1$. Mean participant bias composites and standard deviations for persecutory (paranoia relevant) and negative (social anxiety relevant) items are indicated in Table 6.4. To interpret this two-way interaction follow up independent sample t-tests were conducted for each type of bias content separately (persecutory, negative).

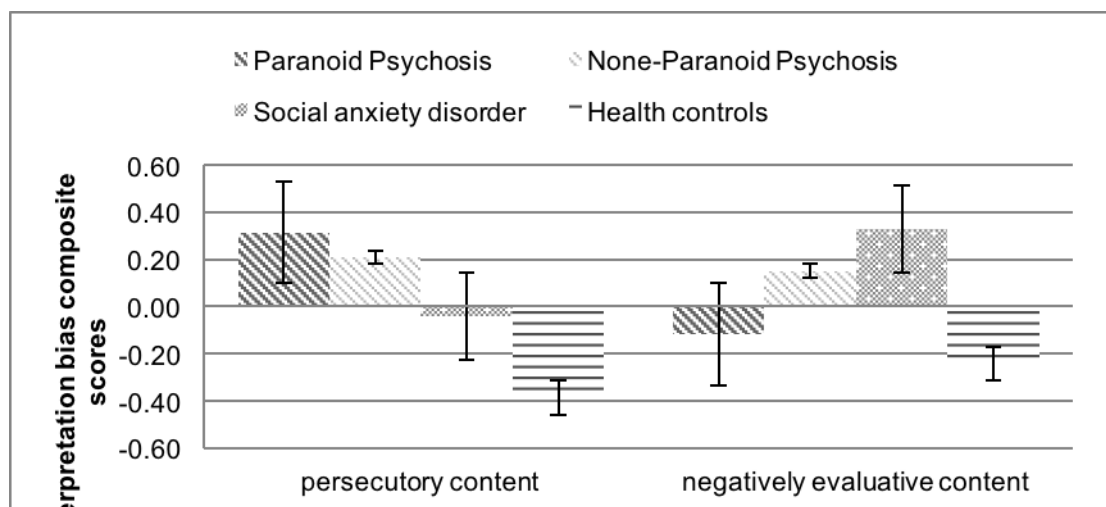
Paranoid content:

Follow-up independent sample t-tests showed that all patient groups had significantly higher persecutory bias composites compared to controls (paranoid vs. control, $t(52) = 4.04$, $p < 0.0001$, $d = 0.71$, 95% CI, .35, 1.07, $\epsilon = 1$; non-paranoid vs. control, $t(50) = 3.39$, $p = 0.001$, $d = 0.59$, 95% CI, 0.24, 0.95, $\epsilon = 1$; social phobia vs. control, $t(52) = 1.93$, $p = 0.05$, $d = 0.34$, 95% CI, -.001, 0.70, $\epsilon = 1$). The two psychosis patient groups did not differ significantly from each other in their bias composites of persecutory material, $t(46) = 0.63$, $p = 0.54$, $d = 0.12$, 95% CI -0.26, 0.48, $\epsilon = 1$). Finally, the paranoid psychosis patient group and social phobia patient group did differ significantly from each other in their bias composites of persecutory material, $t(48) = 1.97$, $p = 0.05$, $d = 0.37$, 95% CI -0.01, 0.75, $\epsilon = 1$).

Socially anxious content:

Follow-up independent sample t-tests showed that the social phobia patient group had significantly higher negative bias composites compared to controls, $t(52) = 3.18$, $p = 0.003$, $d = 0.57$, 95% CI, 0.21, 0.93, $\epsilon = 1$, while both psychosis groups were not significantly different in their negative bias composites compared to the control group. The social phobia patient group did not differ in persecutory bias composites compared to the paranoid psychosis patient group (social phobia vs. paranoid, $t(48) = 1.83$, $p = 0.07$, $d = 0.36$, 95% CI, -0.04, 0.76, $\epsilon = 1$), and to the non-paranoid psychosis patient group (social phobia vs. non-paranoid, $t(46) = 1.15$, $p = 0.26$, $d = 0.25$, 95% CI, -0.19, 0.69, $\epsilon = 1$).

Figure 6.5: Patterns of interpretation bias on the composite bias scores across groups



Note: Interpretation bias composite scores calculated based on raw bias score of the SRT, SST, and the WSAP, as referred back to Section 5.4.3, which represented negatively

evaluative content (social anxiety related) and persecutory content (paranoia related) separately.

Figure 6.5 illustrates the findings from the SST bias composites, reflecting the above two-way interaction ($F(3, 97) = 3.18, p = 0.03$), namely, that significant group differences in the interpretation of ambiguous material were detected, which vary in strength and direction according to the match between the type of material and the primary symptoms involved in the psychopathology of each group. These findings support hypothesis I by revealing a specific bias in the interpretation of ambiguity related to potentially paranoid content in paranoid patients when compared to the healthy control group, and support hypothesis II by revealing a specific bias in the interpretation of ambiguity related to potentially socially anxious content in social phobia patients. In contrast, hypothesis VI was not supported as the degree of content specificity did not differ significantly between the two psychosis patient groups. Hypothesis VII was also not supported as the degree of content specificity did not significantly differ in negative content between the social phobia and paranoid psychosis patient groups.

In order to test if there was content-specific interpretation bias in paranoid patients and social phobia patients we conducted paired-sample t-tests between persecutory bias composites and negative bias composites for each group separately (paranoid patient group, social phobia patient group). In the paranoid psychosis patient group paired-sample t-tests showed that the group had significantly higher bias composites when completing persecutory material (mean = 0.33, SD = 0.66) than negative material (mean = -0.04, SD = 0.60), $t(24) = 2.69, p = 0.013$. In the social phobia patient group, paired-sample t-tests showed that the group had significantly higher bias composites when completing negative material (mean = 0.33, SD = 0.79) than persecutory material (mean = -0.04, SD = 0.67), $t(24) = 3.06, p = 0.005$. Thus hypotheses III and IV were supported as both paranoid psychosis patient groups and the social phobia patient group show content-specific interpretation bias in their symptom congruent material.

6.5 Discussion

This study has addressed three related questions and it tested the main hypothesis of this thesis, whether interpretations of emotionally ambiguous information can distinguish different

clinical groups via biases that match to their pathology. We expected that the paranoid patient group would show more persecutory interpretation bias than the social anxiety patient group, and the non-paranoid patient group, while the social phobia group would show more negative interpretation bias than the paranoid patient group. We also examined if all the patient groups would be more biased in their interpretations of emotionally ambiguous information than the controls. We expected that the paranoid patient group would show more persecutory interpretation bias than the healthy control group, while the social phobia patient group would show more negative interpretation bias than the healthy control group. Finally, we examined whether there is content-specific interpretation of emotionally ambiguous information in the paranoid psychosis patient group and the social phobia patient group. We expected that the social phobia patient group would show more negative bias than persecutory bias, while the paranoid psychosis patient group would show more persecutory bias than negative bias. Three experimental cognitive tasks reflecting the same cognitive process (interpretation of ambiguity) were analysed separately in order to address these three questions. Composite interpretation bias scores were created in line with previous experiments to address the same questions. This discussion deals with each question in turn, first providing a summary of the results in a tabulated form, then providing an interpretation, followed by explanations of unexpected findings, a discussion of the limitations, and the implications of the study.

6.5.1 Summary and Interpretation of the Results

A summary of the key findings is presented in Figure 6.5, and the results of the composite bias scores are the most compelling in this thesis. As explained previously, composites provide convergent validity for the construct measured by including several measures of the same phenomenon. The composite data showed that all patient groups were more biased in their interpretations of emotionally ambiguous information than the controls. Two of the three tasks (SRT and SST) showed consistently that the paranoid psychosis patient group showed more persecutory interpretation bias than the healthy control group. One of the three tasks (SST) showed consistent results whereby the social phobia patient group showed more negative interpretation bias than the healthy control group. Thus, the results generally support hypothesis II. These findings are consistent with those of previous studies

comparing interpretation bias between patient groups and healthy controls (Voncken et al., 2003 de Viries, 2003; Voncken et al., 2007 2007).

Table 6.5: Summary of the key findings

		Hypothesis 1	Hypothesis 2			Hypothesis 3
	Bias content	Whether patient groups are more biased in their interpretations than the control group	Whether there is content-specific interpretation			Whether interpretation biases distinguish the corresponding group
			PA vs. NPA	Paranoid vs. Socially anxious bias		
				PA	SA	
SRT	Socially anxious	x	-	x	✓	x
	Paranoid	✓	x			✓
SST	Socially anxious	✓	-	✓	x	✓
	Paranoid	✓	x			x
WSAP	Socially anxious	x	x	x	✓	x
	Paranoid	x	x			x
Composite bias	Socially anxious	✓	-	✓	✓	x
	Paranoid	✓	x			✓

Note: Social phobia patients group matches is shown on grey rows, and social phobia patients group is shown on white rows. SA = social phobia patients group; PA = paranoid psychosis patients group, NPA=non paranoid psychosis patient group

In support of our second hypothesis, the results of the composite data clearly follow the proposed trend. More paranoid interpretation than socially anxious interpretation was found in the paranoid psychosis patient group, while more socially anxious interpretation than paranoid interpretation was found in the social phobia patient group. Furthermore, one of the three tasks showed consistent findings with the composite results of the paranoid psychosis patient group, and two of the three tasks showed consistent findings with the composite results of the social phobia patient group. Thus, hypothesis three on the content specificity of interpretation bias was firmly confirmed. However, the content specificity in paranoid interpretation was not supported by the comparison between the paranoid and non-paranoid psychosis patient groups, although there was a clear trend in all data which showed that the paranoid psychosis patient group scored higher than the non-paranoid patient group, but statistical significance was not reached.

The third question addresses the major concern of this thesis: whether interpretations of emotionally ambiguous information can distinguish between different clinical groups via biases that match to their pathology. Results from the paranoid content of interpretation bias were convincing, while the results from the socially anxious content of interpretation bias were less so. The most important composite data showed that the paranoid psychosis patient group had significantly higher scores for paranoid content than the social phobia patient group and controls, while the SR task yielded consistent results. However, the difference in socially anxious content between the social phobia patient group and the paranoid psychosis patient group was not significant, and reached only the marginal probability of 0.07, while one of the three tasks showed significant result that supported our first hypothesis. Thus, hypothesis I was firmly supported by the data on interpretation bias with paranoid content, which is in line with our findings from previous studies (Savulich et al., 2015) in subclinical populations. It also supports the cognitive theory of paranoia (Freeman et al., 2002), which suggests a distinct cognitive bias in the understanding of paranoia and paranoid psychosis. Although there was less support for the interpretation of socially anxious content, the data showed a clear trend that social phobia patients had higher bias scores in interpreting socially anxious content than the paranoid psychosis patient group.

6.5.2 Unexpected Findings and Possible Explanations

Although the results were generally promising, there were a few inconsistent findings within each task analysis. The composite bias scores and SRT scores did not show a significant difference between the social phobia patient group and paranoid psychosis patient group in the socially anxious interpretation bias. There was also no significant difference between the paranoid and non-paranoid psychosis groups in the persecutory interpretation bias. However, the mean value of the bias scores from each group showed a clear trend that social phobia patients had higher bias scores when interpreting socially anxious content than the paranoid psychosis patient group. We therefore argue that the small sample size could be a reason for this unexpected finding.

SST data was unable to reveal a significant difference in the interpretation of paranoid content between the paranoid psychosis patient group and the social phobia patient group. More interestingly, the mean figure showed a trend that the social phobia patient group had

higher scores than the paranoid psychosis patient group in paranoid content, which is opposite to that proposed. This resembles the findings from Experiment 3, where the effect of the persecutory interpretation bias in paranoia trait is especially pronounced when participants also display a strong negative interpretation bias. Thus, a similar investigation into the interactive effect of persecutory interpretation at the severe end of social anxiety is suggested for future research.

Although conclusions about the content specificity of the current data were mainly clear, a few task results did not show clear evidence of differences in interpretation bias according to content. The social phobia patient group did not demonstrate a statistical difference in interpretation bias according to content on the SST task, while the paranoid psychosis patient group did not present a statistical difference in interpretation bias according to the content for SRT and WSAP tasks. However, the mean trend showed notable differences between the content of interpretation bias, and followed the proposed trend that the social anxiety group showed more negatively evaluative interpretation bias than persecutory bias in the SST task, while the paranoia anxiety showed more persecutory interpretation bias than persecutory bias in the SRT task. We therefore argue that the small sample size could be a reason for this unexpected finding, and a future study with a larger sample size is recommended.

Lastly, the WSAP task was not able to show any main effect and interaction effect during the group analysis, while a content-specific difference of interpretation bias was only found in the social anxiety group. One possible reason for the lack of a significant effect across these findings may be due to the insufficient power of the study sample. A future study could pursue the proposed questions with a more powerful design. Moreover, there was the possibility of a material effect, as the items developed to distinguish social anxiety and paranoia interpretation were less valid or sensitive in the WSAP task. However, the same strict rating and balancing of new materials across all tasks was employed, which minimised this possibility. A more plausible explanation of the insufficient findings of the WSAP task may be related to the nature of the parameter it tested. WSAP uses response latencies (making relatedness decisions for threat and benign interpretations) as a measurement of interpretation bias. Its reliability and validity has been questioned repeatedly in previous

studies of social anxiety and non-social anxiety groups (Amir et al., 2012 2012; Beard & Amir, 2009). The social anxiety group was characterised by a larger bias score than the non-social anxiety group, indicating more bias toward threat and away from benign interpretation (Beard & Amir, 2009). However, the present data enables us to argue that response latencies may not be a sufficient parameter to characterise the difference between the social anxiety group and the paranoid psychosis group. Response latencies data reflects the ease with which individuals accept or reject interpretations. Thus, another possibility is that our response latencies data may assess a different type of interpretation bias compared to the other two tasks employed in this study.

6.5.3 Limitations

There are limitations to this study. Firstly, only a few of the group analysis results showed the expected patterns on means plot with the absence of statistical significance, suggesting the possibility of the study sample having insufficient power. A future study may extend the findings via a more powerful design. Although the cognitive bias literature has not established a consistent pattern of gender differences in interpretation bias, this could be an important consideration for future research, particularly as psychosis is more prevalent in men (1.4:1; (Aleman, Hijman, de Haan & Kahn, 1999), while social phobia is more prevalent in woman (1.3:1; (McLean, Asnaani, Litz & Hofmann, 2011)). Although we suspect a gender difference effect, this is not our primary research question, and this study did not study gender differences as an important effect. In addition, the sample size of this study was too small and imbalanced to allow this question to be meaningfully addressed. Secondly, although there were conclusive findings of interpretation differences between the groups, and group differences between interpretation content, there was no direct modification of interpretation, and whether interpretation bias is a cause or consequence of corresponding symptoms has yet to be investigated. This limited the ability to infer causal relationships between interpretation bias and the development of corresponding clinical symptoms. A future study could pursue this question with respect to the cognitive models of information processing bias in emotional disorders (Beck, 1971; Weintraub, Segal & Beck, 1974). Thirdly, response latency measured in the WSAP task may be a less sensitive parameter to detect interpretation differences between the social anxiety group and paranoia group.

However, this should be suggested with caution, as there are replicated findings which show interpretation differences between social anxiety and non-social anxiety group using response latency data from the WSAP task (Amir et al., 2012 2012; Beard & Amir, 2009).

6.5.4 Implications

Our experiment has both theoretical and practical implications. Findings from a clinical sample can be applied directly to the clinical understanding of social anxiety and paranoia. These are consistent with the existing knowledge of the content specific role of interpretation bias in the maintenance of clinical symptoms (Weintraub et al., 1974). Differences of interpretation bias can be distinguished by the related symptom characteristics, while differences in symptom characteristics can be distinguished by the related interpretation bias. For example, a vulnerable individual negatively interprets strangers whispering, indicating the presence of social anxiety traits/symptoms, and when an individual interprets the same information as having a harmful intention then this indicates the presence of paranoid traits/symptoms. Considering content differences in their biased interpretations could be important in gaining insight into the progression of their symptoms, and may warrant specific assessments of symptoms with pathology matched interpretation bias.

The results of this study emphasise the importance of interpretation bias in cognitive bias modification (CBM). In targeting the core biased interpretation processes underlying symptoms, the CBM technique has focused on the potential to modify negative interpretation biases so that ambiguity is resolved more positively (Mathews and Macleod, 2000; (Mackintosh, Mathews, Yiend, Ridgeway & Cook, 2006). For example, studies have successfully demonstrated that a single session of CBM can have a significant impact on both interpretation bias and anxiety levels (Hays et al., 2010; (Salemink, van den Hout & Kindt, 2009). This study has extended the previous findings by demonstrating biased interpretation in psychosis, and how the biased interpretation of socially relevant information differs in the compared groups with relevant diagnoses. A more direct approach focusing on persecutory interpretation biases underlying the maintenance of paranoid psychosis could be considered in future CBM studies.

6.6 Conclusions

This study has demonstrated whether different content of interpretation bias can distinguish social anxiety from paranoid psychosis. Overall, the results of the group comparison analysis generated consistent findings across the clinical and control groups. We found a content specific interpretation bias in both the social anxiety and paranoid psychosis groups. In addition, the expected group differences for each type of interpretation bias (socially anxious resolutions/paranoid resolutions) were confirmed. Differences of interpretation bias can be distinguished by the related symptom characteristics, while differences of symptom characteristics can be distinguished by the related interpretation bias. However, the WSAP was not able to show any valid results and there was also no significant difference between paranoid and non-paranoid psychosis groups in persecutory interpretation bias. However, the mean value of the bias scores from each group showed a clear trend, with social phobia patients having higher bias scores in interpreting socially anxious content than the paranoid psychosis patient group. Future studies may strengthen the present findings by employing a more powerful design. The efficiency of using response latency (WSAP) to test interpretation differences between clinical groups is questionable and a future study could replicate the design to confirm the findings.

Chapter 7 General Discussion

7.1 Brief Introduction

The aim of this thesis was to investigate: (1) whether differences in trait/symptom characteristics can be distinguished by the related interpretation bias; and (2) the etiological role of interpretation bias in social anxiety and paranoia. To answer these questions Experiment 1 ($n = 84$) investigated whether the magnitude of matched interpretation bias is associated with social anxiety and paranoia. Experiment 2 ($n = 80$) extended Experiment 1 by using a two alternative choice design in cognitive tasks to investigate the content specificity of interpretation bias in social anxiety and paranoia. Based on the promising findings from the cross-sectional data obtained from Experiments 1 and 2, Experiment 3 ($n = 71$) investigated whether specific interpretation bias precedes the development of corresponding emotional traits during a 6-month longitudinal study. By using a combination of existing and new data collected over a six month period, Experiment 4 tested the hypothesis of reciprocal causality: do traits contribute to the exacerbation of congruent biases in addition (Experiment 4) to biases maintaining traits (Experiment 3), such that a vicious cycle is established? Extending the findings from a subclinical population, Experiment 5 ($n = 102$) compared a group of social anxiety disorder patients and a group of psychosis patients to investigate whether differences in symptom characteristics can be distinguished by the related interpretation bias. The following section summarises the main findings of each of the experiments, and then discusses the theoretical and clinical implications. Finally, the strengths and limitations are discussed with suggestions for future research.

7.2 Main Findings

Experiment 1: Investigation of interpretation bias in social anxiety and paranoia

Experiment 1 examined if there were specific responses to interpretation bias which were dependent on trait characteristics. Evidence was found that matched biases were significantly associated with the severity of social anxiety and paranoia. Individuals were more severely vulnerable to social anxiety when they produced a negatively evaluated interpretation compared to a persecutory interpretation of socially ambiguous information during the cognitive tasks, while individuals were more severely vulnerable to paranoia when they produced a persecutory interpretation rather than a negatively evaluated interpretation. These results are consistent with previous literature which has looked at other traits associated with psychopathology, and established promising findings for developing the subsequent experiments presented in this thesis. With respect to the questions investigated in this thesis, this study also examined the opposing view of the first finding: whether specific vulnerability to trait characteristics is dependent on the content of biased interpretations. The negatively evaluated (social anxiety congruent content) interpretation bias was found to be more strongly associated with social anxiety than the persecutory (paranoia congruent content) interpretation bias. Conversely, the persecutory (paranoia congruent content) interpretation bias was more strongly associated with paranoia than the negatively evaluated (social anxiety congruent content) interpretation bias. Although due to the cross-sectional design the results were limited in explaining the etiological importance of interpretation bias, this experiment established promising directions for later studies.

Experiment 2: Content specificity of interpretation bias in social anxiety and paranoia

Experiment 2 was an extension of Experiment 1 and altered the task design to directly contrast paranoid and socially anxious interpretations (rather than contrasting paranoid versus non-paranoid, and then separately, socially anxious versus non-socially anxious). In addition, this experiment used the image based Relatedness Judgment Task (RJT) instead

of the Word Sentence Association Paradigm (WSAP) from Experiment 1, in order to enrich the testing dimensions and seek evidence in another media context rather than text alone. The same analytical strategy was applied, which first examined if there were specific responses to interpretation bias dependent on the trait characteristics, and then tested the questions investigated in this thesis. Under the forced-choice experimental design, the results showed that there was a significant association between persecutory interpretation and its content-specific emotion (paranoia). This was consistent with the findings from Experiment 1, and enhances the content specificity findings by directly contrasting paranoid and socially anxious interpretations. It was suggested that individuals with high paranoia severity made more persecutory interpretations than negatively evaluated interpretations when these two alternative possible interpretations were presented simultaneously. However, the results were less conclusive and were not in line with Experiment 1 in the association between negative interpretation and its content-specific emotion (social anxiety). Individuals with high social anxiety severity made more persecutory interpretations than negative interpretations. In respect of the etiological questions investigated in this thesis, Experiment 2 found that both types (negatively evaluated and persecutory) of interpretation bias were significantly associated with social anxiety trait. This suggested that in the forced choice setting, individuals with high severity of trait anxiety were likely to adopt more severely threatening interpretations of ambiguous information, according to the hierarchy of paranoia proposed by Freeman and colleagues (2005). It was proposed that the severity of threatened harm increased from social anxiety worry, which is suggested as the most common type of suspiciousness, to severe harm and conspiracy, which is at the top of the hierarchy of paranoia.

Experiment 3: The etiological role of interpretation bias in social anxiety and paranoia

Experiment 3 extended the cross-sectional findings through a longitudinal design with a six month follow up to test the etiological role of interpretation bias in social anxiety and paranoia. Evidence of a predictive role of interpretation bias was found respectively in the two traits. When controlling for the effect of persecutory interpretation bias, there was a

content-specific temporally predictive role of negatively evaluative interpretation bias in the presence of social anxiety traits, while there was a temporally predictive role of persecutory interpretation in the presence of paranoia when controlling for the effect of negatively evaluated bias. Thus, individuals who showed negative interpretations were more likely to later display elevated trait social anxiety, while individuals who showed persecutory interpretations were more likely to report elevated trait paranoia 6 months later. Of particular interest was the interaction effect between negatively evaluative and persecutory interpretation bias, which showed that the effect of the persecutory interpretation bias was especially pronounced when participants also displayed a strong negative interpretation bias. This suggested that individuals who explained social ambiguity with persecutory intention (e.g. 'people harm me') were likely to suffer from higher paranoia 6 months later, and this was increased if they also assumed moderately (e.g. 'people criticise me') to extremely negative intentions (e.g. 'people hate me').

Experiment 4: Testing reciprocal causality: do trait emotions maintain corresponding interpretation biases in social anxiety and paranoia?

Experiment 4 extended Experiment 3 by using a combination of existing and new data collected over a six month period to test the hypothesis of reciprocal causality: do traits contribute to the exacerbation of congruent biases in addition (Experiment 4) to biases maintaining traits (Experiment 3), such that a vicious cycle is established? It was proposed that a specific trait emotion at one time point predicts an individual's interpretation style six months later. The results suggested a reciprocal causality of trait social anxiety in corresponding negatively evaluative interpretation bias. However, there was no similar contribution of the trait paranoia to persecutory bias, and the trait social anxiety was instead the only significant contributor. These findings confirmed the vicious circle proposed by cognitive theories of social anxiety, and were in line with the cognitive model proposed by Freeman and colleagues (2002). They suggested a high severity of anxiety with social ambiguity should be given a central role in the model of paranoia. Levels of anxiety are high many years before the development of psychosis (Jones, Rodgers, Murray & Marmot, 1994) and significantly contribute to the cognitive component of paranoia. Future work should re-

examine the role of the trait social anxiety and the trait paranoia in maintaining persecutory interpretation bias in a clinical sample to improve its generalisability in a clinical setting. Theoretical accounts of cognitive processes in paranoia may need to be refined and revised in the light of the above empirical findings.

Experiment 5: Distinguishing clinical social anxiety from paranoia: roles of interpretation bias

Experiment 5 extended the findings from the subclinical sample into a clinical population using a group comparison design. It first examined if all the patient groups would be more biased in their interpretations of emotionally ambiguous information than the controls, if there is content-specific interpretation of emotionally ambiguous information in the paranoid psychosis patient group and social phobia patient group, and finally, the main hypothesis of this thesis, if interpretations of emotionally ambiguous information can distinguish different clinical groups by biases that match to their pathology, in other words can a double dissociation be observed. The results showed that all the patient groups were more biased in their interpretations of emotionally ambiguous information than the controls, and the content specificity hypothesis was confirmed in social phobia patients and paranoid psychosis patients. More paranoid interpretations than socially anxious interpretations were found in paranoid psychosis patients, while more socially anxious interpretations than paranoid interpretations were found in social phobia patients. However, the double dissociation comparison between paranoid and non-paranoid psychosis patients showed no significant difference in persecutory interpretation bias.

7.3 Theoretical and Clinical Implications

Promising evidence was observed across the results presented in this thesis, which have significant theoretical and clinical implications.

7.3.1 The Magnitude of Interpretation Bias is Associated with Trait Severity of Social Anxiety and Paranoia

Beck's cognitive theory (1971) of psychopathology posits that affective characteristics are determined by persistent cognitive patterns, and a specific affect is congruent with its

specific thought content (Beck, 1976). Thus, if an individual's interpretation of a situation has an unpleasant content, then they will experience a corresponding unpleasant affective response. Based on this notion, previous studies showed that there was characteristic negative bias within different affective disorders (Beck, Emery & Greenberg, 1985; Clark & Beck, 1988; Clark & Wells, 1995; Mathews & MacLeod, 1994; Mathews & Mackintosh, 1998). For example, socially anxious patients were pre-occupied with fearful automatic thoughts about social danger and risk (e.g. Stopa and Clark; 2000; Amir, Beard & Bower, 2005; Wilson & Rapee, 2005). Cognitive behaviour therapy developed from this model thus focuses on the catastrophic misinterpretation of symptoms and the extinction of avoidance behaviour. More recently, studies of psychiatric disorders have also started to test and apply this notion, and it has been found that the misinterpretation of auditory hallucination as threatening can lead to distress (e.g. Morrison & Baker, 2000; Vaughan & Fowler, 2004), with this notion being investigated in both psychiatric and psychotic disorders. Links between disorders have remained mainly on the epidemiological level (e.g. Martin & Penn, 2001; Johns et al. 2004), or affective concerns (Freeman et al., 2001; Freeman & Garety, 2000). A boundary has been established in between, and the highly comorbid nature of cognitive vulnerabilities has been neglected. Consequently, we do not know whether the content of interpretation bias differs depending on the severity of characteristic symptoms.

Experiment 1 was the first to investigate the association between biased interpretations and trait characteristics involving both social anxiety and paranoia. As expected, severe trait characteristics were associated with catastrophic interpretation bias, which was significantly related with its content congruent trait severity. The results indicated an incremental linear pattern between interpretation bias and trait severity of social anxiety or paranoia. The more individuals exhibited negatively evaluated interpretation the more they were vulnerable to severe social anxiety, while the more individuals exhibited persecutory interpretation the more they were vulnerable to severe paranoia. Understanding this pattern is important for several reasons, the first being it will help further refine cognitive theories of social anxiety (Clark & Wells, 1995, Rapee & Heimberg, 1997; Williams et al., 1988; Mathews & Mackintosh, 1998) and paranoia (Bentall et al., 1994; Freeman et al., 2002). For example, the findings of Experiment 1 support these theories by confirming the assumption that an

incremental linear relationship exists between emotion traits and trait congruent interpretation bias. Experiment 2 further confirmed the assumption that each emotional disorder is associated with a specific biased cognitive pattern (Williams et al., 1988), and found that an interpretation bias (e.g. persecutory interpretation) is more strongly associated with one content matched emotion trait (e.g. paranoia) over another (e.g. social anxiety). Nevertheless, there are also findings which suggest a revision of the current theoretical assumption is required, as Experiment 4 only confirmed the assumption of a reciprocal relationship between emotion and cognition on the social anxiety side but not the paranoia side.

The lack of contribution from the trait paranoia to persecutory interpretation calls for a revision of the existing theories. Investigating the relationship between the severity of emotion traits and interpretive bias is likely to be helpful in guiding existing and future interventions and therapies. For example, findings of the interaction effect of negatively evaluated interpretation and the linear pattern between persecutory interpretation and paranoia suggests that both negatively evaluative and persecutory interpretation biases might be targets for paranoia intervention, and the applicability of adopting the cognitive therapies of social anxiety symptoms for paranoia symptoms, as promoted by a recent research trend in this area (e.g. (Freeman, 2014 #1001); (Freeman, 2015 #1017).

7.3.2 There is Content Specificity of Interpretation Bias in Content Congruent Emotion Traits

It was hypothesised that there was a content-specific association between interpretation bias and its content-matched emotion traits. An individual's trait characteristics might differ depending on the content of their interpretation styles (Williams et al., 1988; Mathews & Mackintosh, 1998), and there is support for this from each experiment presented in this thesis to some extent. The results of Experiment 1 confirmed the linear pattern of this relationship, and demonstrated a significant association between interpretation and its content-specific emotion trait (e.g. the negatively evaluated interpretation bias was more strongly associated with social anxiety than the persecutory interpretation bias, while the persecutory interpretation bias was more strongly associated with paranoia than the negatively evaluated interpretation bias). Experiment 2 extended this by altering the task

design to directly contrast paranoid and socially anxious interpretations (rather than contrasting paranoid versus non-paranoid, and separately socially anxious versus non-socially anxious in Experiment 1) to achieve a direct test of content specificity. This demonstrated consistent results between persecutory interpretation and paranoia, whereby individuals with high paranoia severity made more persecutory interpretations than negatively evaluated interpretations when two alternative possible interpretations were presented simultaneously, and persecutory interpretations were weighted more than negatively evaluated interpretation in the linear pattern of the relationship with the trait paranoia. Furthermore, the same pattern was confirmed in the clinical setting of Experiment 5, where more paranoid interpretation than socially anxious interpretation was found in the paranoid psychosis patient group, while the paranoid psychosis patient group had significantly higher scores in paranoid content than the social phobia patient group.

However, the results of the longitudinal data from Experiments 3 and 4 are more complex. In the test of the causal role of interpretation bias in Experiment 3, persecutory interpretation bias and negative evaluated interpretation bias explained the variance of the paranoia trait almost equally. In addition, it was suggested that the persecutory interpretation bias is especially pronounced when participants also display a moderately to extremely negative interpretation bias. This results support the existing hierarchical structure of paranoia (Freeman et al., 2005), whereby there is a continuous distribution of paranoia beliefs in the general population; however, they also implied a refining of this structure. The less plausible paranoid interpretation (in top hierarchy 'people try to cause harm to me') builds upon commoner, more plausible, socially anxious ones (in bottom hierarchy 'people ignore/criticise me'), and the existing interactions between these interpretation biases should be considered, as each level of bias in the hierarchy may not purely stand alone. In the test of the reciprocal causality of different traits (social anxiety versus paranoia) in persecutory interpretation, an absence of the proposed content-specific match was found, and the trait social anxiety contributed more to the prediction of the persecutory interpretation bias six months later. Although one may argue that the high severity of pre-existing anxiety together with social ambiguity is particularly significant in the cognitive component of paranoid individuals (Freeman et al., 2002), given the complex nature of psychosis and paranoia

further investigation was suggested to re-assess this finding. Finally, the content specificity in paranoid interpretation was not supported in a comparison between the paranoid and non-paranoid psychosis patient groups.

There are much more solid results for the content-specific association between negatively evaluated interpretation bias and social anxiety. The findings from the cross-sectional data (Experiment 1), longitudinal data (Experiments 3 and 4), and clinical data (Experiment 5) all confirmed the proposed content specificity assumption. However, the results of Experiment 2 were less conclusive and were not in line with the other findings.

When participants were forced to make interpretations of socially ambiguous information between negatively evaluative and persecutory choices, individuals with high social anxiety severity were found to make more persecutory interpretations than negative interpretations. In respect of the etiological questions investigated in this thesis, both types (negatively evaluated and persecutory) of interpretation bias were found to be significantly associated with the social anxiety trait. These findings raised questions regarding whether there was also a quantitative difference between negatively evaluated interpretations and persecutory interpretations, in addition to the generally agreed qualitative differences ('concerning negative evaluation' versus 'concerning harmful intention'). For example, the lower end of the persecutory interpretation bias indicated the most common type of suspiciousness with a social evaluative theme, such as fears of rejections (Freeman et al., 2005). As the severity of the threatened harm increased, the less common theme and more suspicious content was involved, such as severe harm, conspiracy (at the top of the hierarchy). The results thus suggested cognitive concerns for the comorbid symptom of social anxiety at the lower severity of paranoia symptoms.

7.3.3 The Etiological Importance of Interpretation Bias in Social Anxiety and Paranoia

Cognitive bias is thought to be an important etiological factor that contributes to the psychopathological understanding of affective disorders (Clark 2001). Specific cognitive content may precede the later development of corresponding disorders (Alford et al., 1995). A limited number of studies have investigated whether specific cognitive content (e.g. factors

that theoretically are related to cognitive vulnerability, such as negative interpretation, and persecutory) distinguish or predict the later development of the corresponding disorders (Rholes et al., 1985). Few have assessed interpretation bias as a cognitive vulnerability factor in distinguishing different emotional symptoms, even fewer have used a longitudinal setting to test the causal role of interpretation bias, and none have expanded their research to psychiatric disorders through comparisons with affective disorders, although socially anxiety is highly prevalent during the prodromal stage of psychosis (Freeman et al., 2005). Combining these notions, Experiment 3 is the first to investigate whether specific interpretation bias at a given point in time can predict one emotional trait severity over another within social anxiety and paranoia. As expected, social anxiety was predicted by negatively evaluative interpretation alone, thus individuals with severe negative interpretation bias were most likely to suffer from social anxiety six months later, while individuals with persecutory interpretation bias were not. Meanwhile, both interpretation contents predicted paranoia, although persecutory interpretation was weighted more than negatively evaluated interpretation in the prediction model. The effect of persecutory interpretation bias is especially pronounced when individuals also display a moderately to extremely negative interpretation bias. This suggested a more complex causality between the different types of interpretation bias and the paranoia trait, which is beyond the common psychopathology proposed by most cognitive theories (e.g. Williams et al., 1988). Given the complex nature of paranoia, the hierarchical structure of paranoia proposed by Freeman and colleagues (2005) explains the findings, as they argued that the anticipation of rejection is a prominent theme of paranoia that is shared with social anxiety. Anxiety-related beliefs play an important role in the formation and maintenance of persecutory interpretation bias (P. A. Garety & Freeman, 1999). The degree to which individuals could control those beliefs distinguished them as experiencing persecutory delusions compared to the general population (D. Freeman, Garety & Phillips, 2000). However, caution needs to be taken when drawing the conclusion that there is a significant impact of negative interpretation in the prediction model, and the results need to be replicated in a larger sample and a clinical population. For example, a recent study of attention bias showed a pattern of biases opposite to that observed using similar methods in subclinical samples to date (Yiend et al., 2015).

When looking into the predictive role of each interpretation bias, persecutory interpretation predicted only paranoia severity and not social anxiety severity. This confirmed relevant cognitive theories in psychosis (Bentall et al., 1994; Freeman, Garety and colleagues, 2001), and suggested the content-specific role of persecutory interpretation bias in predicting paranoia severity. Although social anxiety and paranoia were highly comorbid and even shared some cognitive vulnerability, biased interpretation with persecutory content only pointed towards the later development of paranoia. Experiment 5 strengthened this finding in the clinical group comparisons, as persecutory interpretation bias was more common in the paranoid psychosis group rather than the social anxiety group and all other groups. Thus, persecutory interpretation bias may distinguish paranoia from social anxiety in the data presented in this thesis, and it was evidenced that there was an etiological role of persecutory interpretation bias in explaining paranoia and maybe even paranoid psychosis.

The findings on negatively evaluative interpretation were much more complex, as there was an interaction effect between negatively evaluative interpretation and persecutory interpretation bias in the prediction of paranoia. Interpretations could be categorised into three magnitudes: mild negativity, moderate negativity, and extreme negativity, and it was found that the greatest positive impact of persecutory interpretation was on paranoia traits when participants showed extremely negative interpretation. Thus the extent to which paranoia severity predicted persecutory interpretation bias depended on the magnitude of co-occurring negative interpretation bias. This pattern was consistent with Freeman and colleagues' (2005) hierarchical structure of paranoia, where the distribution of paranoia beliefs in the general population is continuous from mild to severe by socially related concerns. Furthermore, it clarified how negative social concerns interacted with persecutory beliefs, and contributed to the formation of paranoia. For example, it was found that: (1) persecutory thoughts were not absent from the mild level of paranoia; and (2) persecutory beliefs have the greatest causal impact on paranoia, when there was an also catastrophic negatively evaluative concern applied. No theoretical or empirical support can be identified for this last finding. One implied explanation could be that the far end of mild negativity was unlimited and close to the neutral/positive interpretation in the continuous distribution of

paranoia beliefs. Thus the nearer one's socially negative concerns are to neutral, the less likely one's persecutory beliefs may lead to a stable paranoia trait.

7.3.4 Clinical Relevance of the Findings

Higher levels of comorbid mood disorders may hinder progress during treatment for psychosis, thus the identified cognitive factors differentiating paranoid psychosis from social phobia are clinically important. The identification of cognitive vulnerability facilitates the prediction of potential mental health disorders (e.g. Garety & Freeman, 1999; Mathews & MacLeod, 2005; Fiszdon & Reddy, 2012; Casey et al., 2013). This not only benefits the understanding of potential symptoms, but also benefits the targeting of possible early interventions. This thesis has provided subclinical evidence on social anxiety and paranoia, and the data revealed that interpretation bias as a cognitive vulnerability factor represents the possibility for predicting potential emotional vulnerability or even clinical symptoms. Excessive concern regarding negatively evaluative information leads to a great likelihood of social anxiety, while excessive concern regarding persecutory information leads to a greater likelihood of paranoia. Thus, knowing whether an individual's interpretation style is persecutory rather than negatively evaluated may suggest that the potential clinical condition is paranoia related and not social anxiety related. This improves the efficiency of locating the target symptom during diagnosis by implying more precise ways to parse differences between social anxiety and paranoia. Furthermore, it improves the accuracy of applying possible early interventions.

The findings of this thesis also suggest that effects of persecutory interpretation bias are especially pronounced in predicting the trait paranoia when participants also display a moderate to extremely negative interpretation bias. This implies that both negatively evaluative and persecutory interpretation biases could become the target for paranoia intervention, thus if social anxiety related interpretation bias is shown to have a role in paranoia symptoms then the established cognitive behavioural anxiety-reduction techniques might also reduce paranoia symptoms. This result also implies the possibility that when a negatively evaluated interpretation is of sufficient severity, then this may lead to the development of a secondary/comorbid mood disorder in psychosis. Contrastingly, it implies an equally plausible alternative that the observed interpretation biases among individuals

with paranoia may be a consequence of either or both disorders. Thus, a comorbid disorder should be considered if corresponding interpretation bias is detected.

A careful and thorough assessment is critical to intervention planning and clinical research. The significantly linear relationship between interpretation bias and relevant symptoms found in this thesis suggests the advantage of including interpretation bias as one measurement dimension. Assessment measures for social anxiety and paranoid psychosis have typically involved cognitive assessment procedures, such as information processing paradigms (Arnkoff & Glass, 1989; Elting & Hope, 1995; Heimberg, 1994; Andreasen et al, 1992; Green et al, 2004; Pino et al., 2006; Ana et al., 2016). However, most of these assessments have focused only on a limited content type (e.g. Morrison & Baker, 2000; Freeman & Garety, 2008). The interaction effects between different contents of interpretation bias in predicting paranoia symptoms found in this thesis suggested that focusing on one type of content in interpretation may not be sufficient to understand symptoms and produce a larger effect in predicting later onset disorders. The contents of interpretation bias interact with each other and should be considered accordingly.

Clinical interventions for early psychosis suggest the aetiological role of cognitive bias in both the development and maintenance of psychosis (Gumley et al., 2006; Freeman, Hasson-Ohayon & Roe, 2009). Thus the identified interpretation bias as one mechanism related to paranoia highlights the potential to improve the focus of existing cognitive-behavioural therapies (Fowler, Garety & Kuipers, 1995), metacognitive training (Moritz et al., 2010) and other cognitive and social interventions (Roder & Medalia, 2010) for psychosis. Modifying such biases may improve corresponding symptoms, and cognitive bias modification studies have directly tested this assumption. Experimentally designed training programmes for intended interpretation biases (either positive or negative) can be successfully induced, which in turn affect mood, and indicate a causal role for interpretation biases in target mood (Mackintosh et al., 2006; Wilson et al., 2006). An increasing number of studies are providing evidence from clinical populations (Yiend et al., 2011, 2013, 2014; Mackintosh et al., 2006; Salemink, van den Hout & Kindt, 2007; Yiend et al., 2005). Therefore, relevant findings from this thesis may contribute to the development of effective

cognitive bias modification training for psychosis, clarifying the pre-existing bias mechanisms which the training targets.

7.4 Strengths and Limitations

This thesis has a number of strengths, with the first being the cross-sectional and longitudinal design experimental designs. Data from the cross-sectional experiment illustrated the relationship between interpretation bias and trait characteristics at baseline, which suggested the neutral correlation of the investigated variables. The significant results provided the opportunity to test the relationship further in a predictive model in order to investigate the causal role of interpretation bias in the development of social anxiety and paranoia. Longitudinal data provided a dynamic picture of the correlation between the variables, and showed how trait/symptom characteristics are related to interpretation bias over a given time period, and whether baseline interpretation bias predicts the later development of trait characteristics. Taken together, these addressed the proposed question of the etiological role of interpretation bias in the development of social anxiety and paranoia.

One experiment in this thesis involved a group comparison design of clinical groups and control groups, which strengthens the results from regression analysis. Regression data from a wide ranging population, including low to high socially anxious individuals, and paranoid individuals, illustrated the relationship between interpretation bias and trait characteristics in the general population. Further group setting analysis then explained how interpretation bias was represented in the higher end of each trait characteristic group, and in the concerned control groups. This allowed findings to be generated on how individuals with social anxiety or paranoia differed in interpretation bias compared to the general population. As such, it answered the research question on whether specific interpretation biases distinguish social anxiety from paranoia. Moreover, including clinical data extended the potential of where these findings can be applied. For example, they can contribute directly to the clinical understanding of social anxiety and paranoia, which may further direct cognitive intervention targets.

The design of items in the cognitive task, included content directly reflected social anxious (negatively evaluative) concerns and paranoid (persecutory) concerns. This extended

previous common designs for testing interpretation bias, which have mostly adopted either negative or positive content as a control interpretation condition. Previous designs have revealed the magnitude of interpretation bias in relation to the severity of trait characteristics; however, they are limited in generating content-specific explanations. The cognitive tasks in this thesis used items which reflected trait matched contents in order to clarify the direction of the biased interpretation, which allowed an investigation into the content specificity of interpretation bias for corresponding trait characteristics. The content specificity of interpretation bias referred to biases specifically in favour of an individual's emotional concerns matched to core psychopathological traits (e.g. interpreting ambiguous social events as negative to exacerbate social anxiety) (Mathews & MacLeod, 1994). This has been suggested as the central component of the modern cognitive theory of psychopathology (Beck, 1987).

Adopting a forced alternative choice design (Fechner, 1889) in Experiment 2 to strengthen the content-specific finding from Experiment 1 is also a strength of this thesis. This design forced participants to make a choice from two alternatives in a forced setting between socially anxious and paranoid interpretations. The two-alternative choice task data robustly supported the findings from Experiment 1. The rationale of this design was to exaggerate the difference between the two closely related variables and allowed the direct testing of content specificity between socially anxious and paranoid concerns.

Most research to date has only focused on one type of the interpretation bias. Experiments in this thesis used cognitive measurements of interpretation bias in multiple dimensions, which allowed measurements covering all stages of biased interpretation processing. This was accomplished by including pre-existing stereotype interpretations, such as the WSAP, and encountered interpretations within a social context, such as the SRT. Data from self-reported ratings to response latencies were measured, which allowed a more comprehensive explanation of the generated results. The image-based RJT was also employed to enrich the testing dimensions, and was expected to identify whether the content specificity of interpretation bias can be evidenced in another context rather than text alone. Although there were few meaningful findings from this task, the idea of testing interpretation bias with multiple dimensions was still worthwhile.

Despite these strengths, there are also limitations that should be addressed in future research. Firstly, insufficient power of the study sample may be one of the limitations, even though power calculations were used to ensure that the sample size was large enough for the purpose of the experiments. There were a few group analysis results (Experiment 5) which showed the expected patterns on means plot but which were not statistically significant. This might suggest the possibility of insufficient power of the study sample. Thus, increasing the sample size or decreasing the variability in the sample may be of benefit in future research, and a future study could replicate this study with a more powerful design.

All trait measurements were self-reported and cognitive tasks can also be subject to researcher bias. The social desirability bias/the defence mechanism, in which participants may provide socially desired answers rather than their actual response, due to thought suppression making them embarrassed to reveal private details, could not be controlled for.

The only image-based task (RJT) did not yield any valid results and it would be worth conducting further investigations to explain this unexpected finding. Research considering this task may need to be carefully considered. Finally, the experiments in this thesis did not include various ranges of demographical information that could be controlled at baseline, for example, IQ, education, and employment status may be critical factors related to social anxiety and paranoia, and have the potential to vary the results.

7.5 Conclusions

The five studies presented in this thesis suggest that interpretation bias may show an etiological role in the development of social anxiety and paranoia, as the content of biased interpretation predicted the corresponding trait characteristics, and may even distinguish one from the other. This confirms the cognitive theories of psychopathology in social anxiety and early psychosis. This thesis also demonstrated a reciprocal causality between social anxiety and both persecutory and negatively evaluated interpretation bias. It has confirmed the vicious circle proposed by cognitive theories of social anxiety, and suggested a mechanism for the maintenance of persecutory interpretation bias in paranoia. The experimental design in this thesis adopted a more precise specification of both the magnitude and content of interpretation bias that best matched the emotional concerns in socially anxious or paranoid

individuals. The data revealed that although content-specific interpretation bias was weighted the most in the prediction of its corresponding trait characteristics, the effects from the content-unmatched interpretation bias could not be neglected. This was found in the prediction of paranoia, in which the severity of paranoia is predicted by persecutory interpretation bias dependent upon the magnitude of negative interpretation bias. This indicates that the more individuals explain social ambiguity through persecutory intention (e.g. 'people harm me') the more likely they are to suffer from paranoia in 6 months, and this likelihood was found to be significantly increased if they also showed an extremely negative intention (e.g. 'people hate me') instead of a more mild (e.g. 'people criticise me') intention. This finding extends previous observations using similar methods in subclinical samples, and suggests an etiological pattern that goes beyond the notion of content specificity. Future work should attempt to replicate this finding and to explore this notion for other cognitively comorbid disorders. This is particularly important in the context of developing efficient diagnoses and cognitive interventions designed to modify specific biases that may be used in facilitating future therapies. It is important to have a deeper understanding of the nature and type of interpretation biases that occur in social anxiety and paranoia, before we can be confident that inducing specific biases is likely to have clinical effects. The present data points to a need for further research into the interaction effects of interpretation orienting in cognitive comorbid disorders.

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Appendix 1. Similarity rating task Version 1 and 2 items

Two parallel versions of each task were developed and counterbalanced in order across participants to minimise order effects and the influence of other potentially confounding factors.

Version 1- Social anxiety related items (20 items)

Experiment 1, 2, 3, 4, & 5

1. PRESENTATION

You give a presentation during class.

People look interested and applaud at the end.

However, you feel you cannot answer the last *qu-s-i-n* (question).

Did you give a presentation during class? YES

Your presentation is successful

Your presentation is unsuccessful

You are generally a good writer

You are generally a bad writer

2. EMAIL FROM YOUR BOSS

A project you are working on is in its final stage.

This morning, you receive an email from your boss that asks you to visit his office this afternoon.

Your colleague told you that your company is struggling, and some will be fired *s-on*

(soon)

Did you visit to your boss's office this afternoon? YES

Your boss will praise your progress so far and give you a new project

Your boss will tell you the bad news that you will be fired soon

You have had a good relationship with your colleagues

You have endured some problems with your colleagues

3. TEAM MEETING

You have a team meeting about a new project.

Your boss seems to actively listen to your idea and compliments you.

Your boss also seems to give good feedback to your *c-l-e-g-es*

(colleagues)

Do you have a team meeting about the last project? NO

Your boss's compliments mean that you are doing very well

Your boss's compliments mean nothing

Having a new experience is very exciting

Having a new experience is intimidating

4. OVERCOOKED DINNER

You invite some guests who do not know each other to a dinner party.

You are so focused on making your guests feel comfortable.

While talking to your guests, you realize your meal is *o-e-co-k-d*
(overcooked)

Do you invite friends who knew each other? NO

The whole dinner is good, and everyone looks happy

The whole dinner is messed up, and everyone notices how inadequate
you are

You are happy when you receive great wine from your guests

You are unhappy when you receive nothing from your guests

5. VIOLIN PERFORMANCE

You play the violin in an orchestra and recently gave a concert in the
town hall.

You have worked very hard for a perfect performance, but your playing
was slightly out of tune at the end.

The audience clap their hands enthusiastically as your performance
came to an (end)

Did you play the violin at a town hall? YES

You are very good at playing the violin

You are very bad at playing the violin

You finished your music degree with distinction

You barely passed your music degree

6. FIRST MEETING

Your friend introduced someone to you last Sunday.

You think you have a really good time together, and they are really your
type.

Today, they left a message saying that they also had a good time, but just
wants to be good *fr-e-d-* (friends)

Did your friend introduce someone to you on Saturday? NO

There will be many opportunities to meet the right person in the future
You have never been attractive, and no one loves you
Your outfit for the date was a bit old-fashioned
Your outfit for the date was trendy

7. LISTEN TO YOUR MUM

You listen to your mum complaining about her relationships.
You spend all afternoon supporting her.
She tells you she is now feeling better, but still feels helpless about the s-
tu-t-on
(situation)

Do you spend all afternoon with your grandmother? NO

Your support is useful to your mum, and she will be getting better
Your support is useless to your mum, and she will always stay the same
Your mum looks happy with the new skirts she got as her birthday
present
Your mum looks unhappy with the new skirts she got as her birthday
present

8. IN THE LIBRARY

You went to the library to prepare for an exam.
The study room was full of students, but you found a seat.
When you got a seat and started reading, a person sitting across from
you started looking at you o-t-n
(often)

Are you studying at the library? YES

The person across from you kept looking at you because you look very
attractive
The person across from you kept looking at you because you must smell
bad
You will get a very good grade on the exam
You will get a very bad grade on the exam

9. TEST RESULTS

You are in the final year of your studies.
You get a 50 on the final-term assignment and are waiting for the results
of the other exams.
You think about how the other results could affect your f-t-r-
(Future)

Are you in the second year of your studies? NO

You believe that you will get good marks overall and get a job successfully

You believe all your grades will be unsatisfactory and will struggle to get a job

You have tried to get as much experience in your field as possible

You have never tried to get experience in your field

10. YOUR BOSS'S FACIAL EXPRESSION

You have a meeting with your boss in the afternoon.

When you report your progress and discuss new project ideas, you observe your boss scowling.

Finally, they interrupt you and say that they want to discuss the rest next *ti-e*

(time)

Did you have a meeting with your boss in the morning? NO

He scowled and interrupted you because he felt sick or had another meeting soon

He scowled and interrupted you because you made mistakes or reported unsatisfactory results

Your boss's secretary has been very polite in the office

Your boss's secretary sometimes has been very rude in the office

11. UPHOLSTERY CLASS

You have always been passive in relationships and want others to approach you first.

Recently, you have enrolled in an evening upholstery class, and there are many people.

You notice some people who interest you and who you would like to get *cl-s- t-*

(close to)

Are you attending an upholstery class? YES

You imagine that when you approach them they will be friendly

You imagine that when you approach them they will reject you

All subjects in the upholstery class are interesting

All subjects in the upholstery class are boring

12. COFFEE SHOP

You work at a coffee shop and have gotten good feedback from the manager and customers during the last week of your probationary period.

Today is the last day of probation.

While you are serving coffee to a customer, you spill it on the *t-b-e*
(table)

Are you working at a coffee shop? YES

You are generally a qualified employee and will continue working there

You are not a qualified employee and will not continue working there

You get on well with your friends

You do not get well with your friends

13. PROJECT

Recently, you took on a big project that is very important for your next promotion.

You had worked hard on it and submitted the final report. At a meeting with your bosses,

they tell you that your progress was impressive, though your report had a few spelling

(errors)

Did you submit a mid-term report? NO

Your achievement on the project was praiseworthy

Your achievement on the project was inadequate

You got home early and slept well last night

You got home late and slept poorly last night

14. READING CLUB

You led a discussion in a local library reading club last week.

A small number of people joined and had an animated discussion. At the end, the members gave you good feedback, but you doubt the feedback, wondering why there were a lot of *a-g-e-ents*
(arguments).

Did you lead a reading club this week? NO

The members find the discussion you led was useful and pleasant

The members find the discussion you led was unpleasant

The members got along after the discussion

The members hurried home after the discussion

15. CONVERSATION WITH YOUR PARTNER

While you are having a very happy dinner with your partner, you speak of

your future marriage plans.

Soon after, your partner talks to you about recent difficulties in the office. You try to support him, but he keeps *t-l-ing*

(talking)

Does your partner keep talking about difficulties at school? NO

The conversation you have with your partner is enjoyable and constructive

The conversation you have with your partner is terrible and exhausting

When you arrived home, you were greeted by your friendly housemates

When you arrived home, you were greeted by your unfriendly housemates

16. BREAKING OFF A FRIENDSHIP

Two weeks ago, you had a row with your best friend.

Since then, you have not been in touch with her.

When you open your email inbox, you find an email from *h-r*
(her)

Did you argue with your friend one week ago? NO

You can make up with your friend over email and mend the relationship

You cannot make up with your friend; your relationship has been broken for good

Your friend looks happy because she just got engaged

Your friend looks unhappy because she just got engaged

17. WRITING AN ESSAY

You work very hard at writing an essay and send it to your supervisors.

They arrange a meeting to give you feedback.

They comment that your essay is generally very good, but it is a little bit l-ng.

(Long).

Do you meet classmates? NO

The feedback on the essay is positive

The feedback on the essay is negative

You arrive at the meeting on time

You arrive at the meeting late

18. BIRTHDAY PLANS

Your birthday is approaching and you notice your friends being secretive and laughing.

For your birthday you have organised a small dinner.

You are looking forward to it very m-ch [much].

It is your sister's birthday? [No]

Your friends are criticisng your birthday plans

Your friends are planning a surprise party
Your family gossips about you
Your family praises you

19. CORNER SHOP

You're at the counter of your local corner shop waiting to be served.
When it's your turn you find the shop assistant particularly unfriendly.
However, they had been noticeably friendly to the previous c-st--er [customer].

You are in your local corner shop? [Yes]

The shop assistant doesn't like you
The previous customer was a friend of the shop assistant's
Your colleagues envy your success
Your colleagues respect your success

20. FOOTBALL INVITATION

A group of friends invite you to play football.
You have already made plans to meet a friend at the cinema and politely decline.
As the group leaves you hear them l--ghing [laughing].

Have you been invited to play football? [Yes]

The group is making fun of you
The group is having a good time
Your boss slanders you to your co-workers
Your boss names you Employee of the Year

Version 1-Paranoia related items (20 items)

Experiment 1, 2, 3, 4, & 5

1. WHISPERS

After a long morning you enter the canteen for lunch. Whilst waiting in the queue, you look for your colleagues and hope to join them. Across the room, two girls begin to wh-sp-r [whisper].

Did you enter the canteen for lunch? [Yes]

The girls are plotting against you
The girls are talking about their friend
Your doctor gives you suspicious medication
Your doctor gives you beneficial medication

2. MEETING WITH A FRIEND

You arrange to meet your friend for lunch at 1:00 p.m. sharp. You have not seen him in ages and look forward to catching up. At quarter to two your friend has still not arr-v-d [arrived].

Have you arranged to meet your friend at the park? [No]

Your friend is deceiving you
Your friend is running late
Your professor enjoys bullying you
Your professor is frequently stern

3. BAG

It is a Tuesday morning and you are running late for work. You are walking quickly to the station when you hear something drop out of your bag. You turn around and a stranger is kneeling on the floor holding your wallet

You are going shopping? [No]

The stranger is a pickpocket
The stranger is helping you pick up your wallet
Your family punishes you
Your family admires you

4. FOOTBALL

It is a Saturday afternoon and you are walking through the park. It is a lovely sunny day and you are looking into the distance at the ducks by the pond. Suddenly a football just misses hitting you on the he-d [head].

Are you walking through the park? [Yes]

The children were deliberately aiming at you
The children accidentally kicked the ball at you
A stranger is threatening you
A stranger is defending you

5. CLASS ACTIVITY

You enrol in a Public Speaking course to improve your presentation skills. Your class is instructed to write and present a persuasive speech. Your peers unexpectedly nominate you to present f-rst [first].

Have you enrolled in a Public Speaking course? [Yes]

Your peers are conspiring against you
Your peers admire your work
You think your neighbour wants to punch you
You think your neighbour plans to help you

6. NEW JOB

After months of anticipation you are promoted to a managerial position. You are now required to interact with prospective clients on a daily basis. A client you have just met seems unexpectedly f--ndly [friendly].

Have you been sacked from your job? [No]

The client is trying to manipulate you

The client is attracted to you

A man trespasses onto your porch

A man arrives to meet your housemate

7. LECTURE

You are required to attend a Statistics lecture twice a week. You enjoy sitting with a group of friends you made last term. After greeting one of your friends, she does not answer b-ck [back].

Are you attending a lecture? [Yes]

Your friend is deliberately annoying you

Your friend did not hear you

You believe evil forces are targeting you

You believe you are in control

8. BUSINESS MEETING

You present a list of new ideas at your monthly office meeting. You hope to encourage positive change within the company. Your co-workers challenge a few of your p--nts [points].

Are you attending the office Christmas party? [No]

Your co-workers are trying to undermine you

Your co-workers are interested in your ideas

There is an intruder in your kitchen

There is a cat in your kitchen

9. FLAT-WARMING PARTY

You look forward to your friend's flat-warming party. You plan to bring a cheese appetizer you often make. The morning of the party, your partner suggests you prepare a native d-sh [dish].

Are you attending a flat-warming party? [Yes]

Your partner is purposely upsetting you

Your partner wants you to show off your excellent culinary skills

The government secretly regulates you

The government openly supports you

10. INTERVIEW

You prepare for a prestigious interview. You are determined to impress your potential employer. Your peers recommend applying to several other positions to avoid d-s-pp--ntm-nt [disappointment].

Are you writing a novel? [No]

Your peers are intimidating you
Your peers are offering sensible advise
You are distressed by sounds from an unknown source
You are soothed by music from the flat above

11. WALKING HOME

As the weather gets warmer, you begin walking to and from work. Whilst walking home, you notice a man looking at you from across the street. You recognize him as the same man you noticed y-st-rd-y [yesterday].

Are you walking home from work? [Yes]

The man is stalking you
The man walks a similar route as you
Your neighbour is trying to irritate you
Your neighbour is trying to comfort you

12. BIRTHDAY PARTY

It is the night of your mother's 50th birthday party. You are hosting the party and hope she has a good time. All of a sudden you begin to feel dizzy, and an acquaintance offers to pour you a dr-nk [drink].

Is it the night of your mother's 80th birthday party? [No]

Your acquaintance is poisoning you
Your acquaintance is calming you
Your friend's child is deliberately annoying you
Your friend's child wants to play with you

13. GROCERY STORE

After a half-day at work, you decide to go food shopping. You drive to the local grocery store. Whilst driving, you keep noticing the same car behind you in your rear view w-nd-w [window].

Are you driving to the grocery store? [Yes]

The car is following you
The car is going to the grocery store
Your brother purposely neglects your call

Your brother accidentally misses your call

14. QUIET EVENING

Your partner is away on business for the weekend. You expect a quiet evening tidying the house and watching a film. Outside, you hear movement as footsteps approach the front d--r [door].

Is your partner away on holiday? [No]

Someone is intruding on your property

A friend is stopping by

Your boss is abusing you

Your boss is supporting you

15. GROUP PROJECT

You are selected to work with a group of colleagues on a project. You have a lot of stress at home and you struggle to remain focussed. Your colleagues express disappointment with your c-ntr-b-t--n [contribution].

Have you been selected to work on a project? [Yes]

Your colleagues have it in for you

Your colleagues are keen to make the project succeed

A group of students harass you

A group of students assist you

16. STREET CROSSING

You rush to the chemist by foot. You hope to pick up a prescription before the store shuts. As you are crossing the street, a stranger suddenly puts his hand on your sh--ld-r [shoulder].

Are you travelling to the cinema? [No]

The stranger is about to assault you

The stranger is protecting you from the traffic

A man walking behind you is following you

A man walking behind you is going to the same destination.

17. CONFERENCE PRESENTATION

You give your first presentation at a business conference. Immediately afterwards, the audience is given the opportunity to ask questions. In particular, you are asked several difficult q--s--ns [questions].

Are you presenting at a business conference? [Yes]

The audience is trying to confuse you

The audience is engaged in your work

You think a stranger has a gun in his pocket

You think a stranger has a wallet in his pocket

18. FRIDAY NIGHT

You are socialising with friends at a pub after work. Unexpectedly, a group of nearby students begin arguing and break into a fight. You keep quiet as one of the students approaches y-u [you].

Are you at a swimming pool? [No]

The student is going to hit you
The student is leaving the fight
A young woman is chasing you
A young woman is in a rush

19. WORK COLLABORATION

You are collaborating with a new colleague on a work project. You do not know each other very well but are determined to work agreeably. Despite your reminders, your colleague misses a critical m--t-ng [meeting].

Are you collaborating at work? [Yes]

Your colleague is sabotaging you
Your colleague is forgetful
Your cocktail is drugged
Your cocktail has the wrong ingredients

20. HIGH SCHOOL REUNION

You arrive at your high school reunion where there are lots of people you have not seen for many years. All your old friends greet you warmly. However one friend does not talk to y-u [you].

Have you graduated high school recently? [No]

Your friend is hostile toward you
Your friend does not recognise you
There is a conspiracy against you
There is a plan for you

Version 2-Social anxiety related items (20 items)

Experiment 1 & 3

1. THE WEDDING RECEPTION

Your friend asks you to give a speech at her wedding reception.
You prepare some remarks and when the time comes, get to your feet.

As you speak, you notice some people in the audience start to laugh

Did you stand up to speak? YES

As you speak, people in the audience laugh appreciatively

As you speak, some people in the audience find your efforts laughable

As you speak, everyone in the audience bursts into applause

As you speak, you notice somebody in the audience start to yawn

2. THE LOCAL CLUB

You are invited to attend a social at a local club, although you don't know any of the members very well.

As you approach the door you can hear conversation and loud music, but as you enter the room it stops for a moment

Do you know most of the club members? NO

As you enter the room the music stops for a moment

As you enter the room everyone stops and stares at you

As you enter the room someone greets you warmly

As you enter the room someone asks why you are there

3. THE BUS RIDE

You get on a bus and find an empty seat, next to one that has a small rip in it.

At the next stop several people get on who know you,
but all of them go and sit somewhere else so the seat next to you remains vacant

Were the people who got on strangers to you? NO

No one can sit next to you because the seat has a rip in it

No one chooses to sit with you so the seat next to you stays empty

The person in the seat next to you talks to you in a friendly way

The person in the seat next to you makes a rip in the fabric

4. THE JOB INTERVIEW

You see a job advertised that you would really like.

You apply and are invited to an interview, where you answer the questions as well as you can.

Reflecting later, you think that the quality of your answers decided the outcome

Did you think about your answers later? YES

You think it must have been your clear answers that got you the job

Reflecting later, you think the quality of your answers lost you the job

Reflecting later, you think it was a good thing you did not take the job

You think that your appearance may have made a bad impression

5. YOUR FIRST PAINTING

You have taken up painting as a hobby, and have just finished your first picture.

You hang it on the wall for your friends to see.

Later you overhear your friends making remarks that make clear their opinion of your picture

Did you leave the painting on an easel? NO

You overhear your friends saying how much they loved your painting

You overhear some friends making critical remarks about your picture

You overhear some complimentary remarks about your furniture

You overhear your friends making fun of your taste in furniture

6. THE HOUSE-WARMING PARTY

Your neighbour has a house warming party and you are invited.

You arrive to find many other guests whom you do not know.

You try talking to some of them, and get an impression of how much they are interested in your conversation

Was the party thrown by a relative of yours? NO

You meet some guests and they find your comments very entertaining

You talk to some guests but see they find your conversation uninteresting

You meet a lot of guests whom you know and arrange to meet again

You don't know any guests and they all ignore you completely

7. A DIFFERENT HAIRCUT

Whilst at the hairdressers, you are persuaded to try a completely different cut.

In doubt about it, you ask a friend, who comments that the style makes you look very different.

Have you changed your hairstyle? YES

Your friend thought this hairstyle makes you look attractive

Your friend thought the new style makes you look terrible

Your friend likes to make comments on your hair style.

Your friend doesn't like to make comments on your hair style.

8. ARRIVING AT A PARTY

You are going to a party at the weekend

and decide to wear a new outfit you have just bought.

Everyone turns to look at you as you arrive

Did you stay in at the weekend? NO

People at the party thought your outfit was flattering

People at the party thought your outfit was awful.

You know a lot of people at the party.

You know few people at the party.

9. SWIMMING WITH FRIENDS

Your friend persuades you to go swimming in an attempt to get fit.
As you pull on your costume beforehand,
you realise that it is a long time since it was last worn

Did you go swimming with your friend? NO

You think that other people will think you look fine in your swimsuit
You think that other people will think you look strange in your swimsuit
People think you are a good swimmer.
People think you are a bad swimmer.

10. JOINING A DINNER

Your colleagues decide to go for a meal from the office and ask you to join them.
You accept, but realize you will have to wear your work clothes.
When you arrive, the other diners turn to look

Did you go out to eat with your colleagues? YES

The other diners look at you because you look very smart.
The other diners look at you because you aren't dressed appropriately.
You found the company during the meal enjoyable
You found the company during the meal boring

11. MEETING YOUR DATE

You arrange to meet your date at 8 p.m. in a local pub.
You arrive on time and find that they are not there yet.
You think back to when you last met and remember the conversation

Did you start your date in the pub? YES

You think your date is late because have been held up
You think your date is late because they are not sure about meeting you again.
You think the local pub is a great place for the date.
You wish you were not meeting at the local pub

12. WEARING A NEW SUIT

You buy a new suit, which is very different from your normal style of clothes.
When you show it to a friend,
they make some strong comments

Did you show your new clothes to your friend? YES

Your friend comments that the new style makes you look fetching.
Your friend comments that the new style makes you look ridiculous.
Your friend likes to go shopping with you.
Your friend doesn't like to go shopping with you.

13. LETTER FROM OLD FRIENDS

You receive a letter out of the blue from an old friend who you have not seen for ages.

She wants to meet and explains that she has changed a lot since you last saw her. You feel that she will think you have also changed

Did you meet an old friend? YES

You expect your friend to think you have changed for the better

You expect your friend to think you have changed for the worse

Your friends like to keep in touch with you.

Your friends never call you unless you call them.

14. LATE HOME FROM WORK

One evening, you are late home from work.

The family have prepared a meal and eaten theirs, but they did not wash up.

As you begin to clear up, your neighbor arrives.

Were you late home from work? YES

You neighbour thinks you look after the family well.

You neighbour thinks you are untidy.

Your neighbor comments favorably on the family's cooking

Your neighbor comments unfavorably on the family's cooking

15. A DINNER PARTY

A friend invites you to a dinner party that she is holding.

She tells you who the other guests are, but you do not recognize any of the names.

You go anyway and on the way there, you imagine what the other guests will think

Were several of your friends going to the party? NO

You think that the other guests will find you sociable

You think that the other guests will find you tiresome

You are pleased to be going to a dinner party

You do not want to go to the dinner party

16. A PEN-PAL IN BELGIUM

You have been writing to a pen-pal in Belgium for several years and finally arrange for him to come and stay with you.

As you stand at the airport waiting for his flight to arrive, you wonder what will be his first impression

Is your penpal from Belgium? YES

You think your penpal's first impression of you will be that you are charming.

You think your penpal's first impression of you will be that you are lifeless.
Your pen-pal likes the gift you sent.
Your pen-pal doesn't like the gift you sent.

17. FUND RAISING EVENTS

As a member of a local charity you are asked to promote your fund raising events on local radio the following week.
You know that the station is widely listened to
and you wonder what other committee members will think.

Were you asked to promote your fund raising events on local radio? YES

The other committee members will think you spoke convincingly.
The other committee members will think you spoke hurriedly.
You find fund raising rewarding and would like to do more of it
You are thinking of giving up your fund raising work

18. LOCAL PUB

You have just moved to a new area and your neighbour asks if you would like to go to your local pub that evening.
When you arrive, they are not yet there.
You imagine what they think about you after your earlier conversation.

Did your neighbour ask you to a local pub? YES

After your earlier conversation, they probably thought you were likeable.
After your earlier conversation, they probably thought you were dull.
You find the new area pleasant
You find the new area unpleasant

19. MEETING FRIEND IN TOWN

You arrange to meet a friend in town.
Last time you met, you had a quarrel and parted on bad terms.
Just before you leave, she phones to say that she can't make it. You wonder why she is (cancelling).

Did you arrange to meet a friend in town? YES

You think that this is because she is feeling unwell.
You think that this is because she is feeling angry.
Your friend likes to chat with you online.
Your friend doesn't like to chat with you online.

20. RINGING FROM WORK

You work in a large office along with your supervisors.
One morning, you have to ring your mother. Everyone else is working quietly

and can hear what you say.
You guess what they will think of your behavior.

Did you ring your father from work? NO

You guess that they think calling your mother from work means you are troubled.
You guess that they think calling your mother from work means you are shirking.
You think your colleagues like you.
You think your colleagues don't like you.

Version 2-Paranoia related items (20 items)

Experiment 1, & 3

1. RUSH HOUR

You are seated on a busy train at rush hour. The train stops and many people get off leaving a number of empty chairs. Immediately the passenger next to you gets up and changes s-at [seat].

You are travelling by bus? [No]

The passenger wants more legroom
The passenger does not want to sit next to you
Your friend is ignoring you
Your friend is busy at work

2. PARTY

You've had a long morning and are looking forward to your lunch break. You walk into the canteen and meet your friends who are discussing a party hosted by a good friend of all of you. This is the first you hear about the p-r-y [party].

Are you eating breakfast? [No]

Your friend is excluding you
Your friend forgot to invite you
Your colleagues are jealous of you
Your colleagues admire you

3. CHRISTMAS CARD

It has been a busy last few months at work and everyone is looking forward to the Christmas holidays. Christmas is only a week away and in a couple of days your holidays will begin. Every year you receive a Christmas card from your colleague but this year you did not receive one in the p-st [post].

Is it Easter? [No]

Your card got lost in the post
Your colleague has fallen out with you
Some children are laughing at you
Some children are laughing at a joke

4. THE LOCAL RESTAURANT

You invite your parents to dinner at a local restaurant. When you arrive the restaurant is busy and you are happy to be seated without waiting. Every time you glance up you make eye contact with your w--t-r [waiter].

Are you dining with your sister? [No]

Your waiter is irritated by you
Your waiter is attentive to you
You think you have a bad reputation
You think you have a good reputation

5. BIRTHDAY PLANS

Your birthday is approaching and you notice your friends being secretive and laughing. For your birthday you have organised a small dinner. You are looking forward to it very m-ch [much].

It is your sister's birthday? [No]

Your friends are criticising your birthday plans
Your friends are planning a surprise party
Your family gossips about you
Your family praises you

6. CORNER SHOP

You're at the counter of your local corner shop waiting to be served. When it's your turn you find the shop assistant particularly unfriendly. However, they had been noticeably friendly to the previous c-st--er [customer].

You are in your local corner shop? [Yes]

The shop assistant doesn't like you
The previous customer was a friend of the shop assistant's
Your colleagues envy your success
Your colleagues respect your success

7. HOCKEY MATCH

Your friend has just been chosen to play on the hockey team. You decide to attend your friend's hockey match to cheer him on. When he comes near you you cheer and shout his name but he never looks at you or acknowledges you being th-re [there].

Are you at a tennis match? [No]

Your friend is deliberately ignoring you
Your friend doesn't hear you and is engrossed in the match
Your peers laugh at you
Your peers laugh at your jokes

8. SUPERMARKET

You are in a supermarket and cannot find what you are looking for. You approach a woman stacking shelves and ask where to go to find the particular item. She does not look up or respond at all [all].

You are in a supermarket? [Yes]

She is rude and doesn't want to help
She is busy and did not hear you
You are humiliated by new office rules
You are protected by new office rules

9. DAY OUT

You agree to a day out at the local park with friends and are the first to arrive, after 30 minutes no one else has turned up. You call a friend asking where everybody is and she mentions the joint decision to change the meeting time. This is the first you have heard of this [this].

You are going ice-skating? [No]

Your friends are trying to annoy you
You didn't receive the text message
Your friend fancies your partner
Your friend gets on well with your partner

10. BUS JOURNEY

It is a Friday afternoon and you are making your way home. You are seated on a busy bus at rush hour. A stranger gets on board the bus and appears to turn around and look at you several times [times].

You are on a tram? [No]

The stranger is suspiciously staring at you
The stranger is looking for a place to sit
Your partner is ignoring you
Your partner did not hear you

11. SATURDAY NIGHT DRINKS

It's a Saturday night and you are at a bar with some friends. You offer to buy the first round of drinks whilst your friends sit down at a table. Whilst at the bar you notice your friends are talking and looking in your direction [direction].

Are you going bowling? [No]

Your friends are talking about you
Your friends are looking to see if you need help with carrying the drinks
Your neighbour does not trust you to babysit
Your neighbour does not trust anyone to babysit

12. CAR PARK

You have parked your car in the supermarket car park and just done your weekly food shopping. On your return to your car you notice a man sat in a nearby car. He is sitting alone and looking out the win-ow [window].

Have you just been to the supermarket? [Yes]

The man is watching you as you unpack your shopping
The man is looking out for a friend he is meant to be meeting
Your friend is talking about you
Your friend is talking about the weather

13. THE TRAIN

You are on the train home from work. At the next stop a spare seat becomes available so you sit down.
You look around the train carriage and notice a couple opposite you who are talking about bad haircuts they have recently se-n [seen].

Do you manage to find a seat? [Yes]

The couple's comments are referring to your haircut
The couple's comments are referring to other peoples' haircuts
Your friend has been avoiding you lately
Your friend has been very busy lately

14. AN EVENT

You are meeting some friends from the year below for lunch in the canteen. As you sit down they are talking about an event that is coming up which they don't really want to go to. In two months it will be your gr-d--tion [graduation].

Are you planning a party for your birthday? [No]

The event which your friends don't want to go to is your graduation
The event which your friends don't want to go to is a revision class
Your brother is trying to hack into your phone
Your brother is trying to fix your phone

15. HOUSE PARTY

It's a Friday night and you are at a friend's house party. At the party you are talking to some girls when two of them get up to leave the room and go outside. They tell you that they will be back sh-rt-y [shortly].

Is it a Thursday night? [No]

The girls are going to talk about you
The girls are going to smoke
Your cousin gives you the cold shoulder
Your cousin is preoccupied

16. THE GYM

You are at a gym class by yourself and are standing near the front of the room.
As there is a large wall of mirrors in front of you you are able to see the two women behind you. The women are looking into the mirror and t-lking [talking].

Are there two women behind you? [Yes]

The women are watching you in the mirror
The women are looking at themselves in the mirror
Your friends whisper about you
Your friends compliment you

17. SHOPPING

You have gone shopping for the afternoon. You walk into a large store with not many customers inside it. There is a sales assistant who is walking around and who occasionally looks in your d-r-ct-on [direction].

Are there lots of customers in the store? [No]

The sales assistant is closely watching you
The sales assistant is closely watching over the shop
The waiter doesn't like serving you
The waiter is distracted

18. A WORK PROJECT

You have been asked to be mentor on a new project at work. You are working with the new interns and a few other members of staff who are also mentors. You overhear one of the interns talking about how strict their mentor has be-n [been].

Are you an intern? [No]

The intern is talking about you
The intern is talking about one of the other mentors
A shop assistant is trying to give you the wrong amount of change back
A shop assistant has miscalculated how much change you need

19. SHOPPING TRIP

It is a Saturday and you have gone to the local shopping centre. You are waiting outside a coffee shop to meet your friend. Just inside the coffee shop are two boys who keep looking through the windows to ou-si-e [outside].

Are you inside the coffee shop? [No]

The two boys are watching you

The two boys are watching the people go by

Your boss is dropping hints about your poor performance

Your boss is discussing your recent achievements.

20. FOOTBALL INVITATION

A group of friends invite you to play football. You have already made plans to meet a friend at the cinema and politely decline. As the group leaves you hear them l--ghing [laughing].

Have you been invited to play football? [Yes]

The group is making fun of you

The group is having a good time

Your boss slanders you to your co-workers

Your boss names you Employee of the Year

Appendix 2. Scrambled Sentences Task Version 1 and 2

items

Version 1- Social anxiety related items and paranoia related items mixed (20 items)

Experiment 1, 2, 3, 4, & 5

1. unhelpful advice friends my constructive found
Social anxiety: friends found my advice unhelpful

Benign: friends found my advice constructive

2. pleasant people to me hostile are
Paranoia: people are hostile to me

Benign: people are pleasant to me

3. disappointed my I friends have pleased
Social anxiety: I have disappointed my friends

Benign: I have pleased my friends

4. I frequently applauded am more persecuted
Paranoia: I am more frequently persecuted

Benign: I am more frequently applauded

5. usually most like people me dislike
Social anxiety: people usually dislike me most

Benign: people usually like me most

6. people me amiable are cruel to
Paranoia: people are cruel to me

Benign: people are amiable to me

7. nobody's see pleased to me everybody's
Social anxiety: nobody's pleased to see me

Benign: everybody's pleased to see me

8. people most have kind intentions hurtful
Paranoia: most people have hurtful intentions

Benign: most people have kind intentions

9. befriend tend ridicule me people to
Social anxiety: people tend to ridicule me

Benign: people tend to befriend me

10. have protecting people threatening me tried
Paranoia: people have tried threatening me

Benign: people have tried protecting me

11. havoc much I create pleasure can
Social anxiety: I can create much havoc

Benign: I can create much pleasure

12. I harassed by am strangers unbothered
Paranoia: I am harassed by strangers

Benign: I am unbothered by strangers

13. ignored I am welcomed know I
Social anxiety: I know I am ignored

Benign: I know I am welcomed

14. please my usually friends disappoint me
Paranoia: my friends usually disappoint me

Benign: my friends usually please me

15. stupidity my reflect my wit words
Social anxiety: my words reflect my stupidity

Benign: my words reflect my wit

16. accepted I by feel rejected others
Paranoia: I feel rejected by others

Benign: I feel accepted by others

17. criticism peoples' I other praise notice
Social anxiety: I notice other peoples' criticism

Benign: I notice other peoples' praise

18. tried helping others me have harming
Paranoia: others have tried harming me

Benign: others have tried helping me

19. lacking your skills impressive social are
Social anxiety: your social skills are lacking

Benign: your social skills are impressive

20. I assisted by am others defeated
Paranoia: I am defeated by others

Benign: I am assisted by others

In the spaces above, write down the number you learned, or as much as you can remember of it.

21. withdrawn people skilled you are say
Social anxiety: people say you are withdrawn

Benign: people say you are skilled

22. trust others it's to better nobody
Paranoia: it's better to trust nobody

Benign: it's better to trust others

23. audience presentation your tires the entertains
Social anxiety: your presentation tires the audience

Benign: your presentation entertains the audience

24. tell usually the truth rarely people
Paranoia: people rarely tell the truth

Benign: people usually tell the truth

25. bad your usually good are relationships
Social anxiety: your relationships are usually bad

Benign: your relationships are usually good

26. find interesting other me people boring

Paranoia: other people find me boring

Benign: other people find me interesting

27. personal you receive compliments often rarely
Social anxiety: you often receive personal compliments

Benign: you rarely receive personal compliments

28. others acknowledged am by ignored I
Paranoia: I am ignored by others

Benign: I am acknowledged by others

29. a returns friend your call avoids
Social anxiety: a friend avoids your call

Benign: a friend returns your call

30. praise me circulate gossip about others
Paranoia: others circulate gossip about me

Benign: others circulate praise about me

31. badly teammates perform well you say
Social anxiety: teammates say you perform badly

Benign: teammates say you perform well

32. strangers me smile often stare at
Paranoia: strangers often stare at me

Benign: strangers often smile at me

33. colleagues angry are with you happy
Social anxiety: colleagues are angry with you

Benign: colleagues are happy with you

34. me people peer at wink other
Paranoia: other people wink at me

Benign: other people peer at me

35. with people pleased you displeased feel
Social anxiety: you feel displeased with people

Benign: you feel pleased with people

36. whisper to talk other colleagues each

Paranoia: colleagues whisper to each other

Benign: colleagues talk to each other

37. to admiringly people talk impatiently you
Social anxiety: people talk to you impatiently

Benign: people talk to you admiringly

38. ignore me tend neighbours to befriend
Paranoia: neighbours tend to ignore me

Benign: neighbours tend to befriend me

39. friends accept new invitations reject my
Social anxiety: new friends reject my invitations

Benign: new friends accept my invitations

40. badly of me speak highly others
Paranoia: others speak badly of me

Benign: others speak highly of me

In the spaces above, write down the number you learned, or as much as you can remember of it.

Version 2- Social anxiety related items and paranoia related items mixed (20 items)

Experiment 1, & 3

1. think I pathetic friends am entertaining
Social anxiety: friends think I am pathetic
Benign: friends think I am entertaining
2. me frequently quite friends commend criticise
Paranoia: friends quite frequently criticise me
Benign: friends quite frequently commend me
3. hideous is people your-outfit think glamorous
Social anxiety: people think your-outfit is hideous
Benign: people think your-outfit is glamorous

4. friendly someone toward aggressive me was
Paranoia: someone was aggressive toward me

Benign: someone was friendly toward me
5. clever you dense a idea suggest
Social anxiety: you suggest a dense idea

Benign: you suggest a clever idea
6. upset others laugh try me making
Paranoia: others try making me upset

Benign: others try making me laugh
7. boring you are colleagues think enchanting
Social anxiety: colleagues think you are boring

Benign: colleagues think you are enchanting
8. helping me have manipulating tried others
Paranoia: others have tried manipulating me

Benign: others have tried helping me
9. is think terrible friends your-haircut nice
Social anxiety: friends think your-haircut is terrible

Benign: friends think your-haircut is nice
10. someone assisting was me stalking home
Paranoia: someone was stalking me home

Benign: someone was assisting me home
11. was fantastic your-party friends disastrous thought
Social anxiety: friends thought your-party was disastrous

Benign: friends thought your-party was fantastic
12. others
controlling thoughts my encouraging try
Paranoia: others try controlling my thoughts

Benign: others try encouraging my thoughts
13. ignore conversation friends enjoy always your
Social anxiety: friends always ignore your conversation

Benign: friends always enjoy your conversation

14. me people befriend tend to injure
Paranoia: people tend to injure me

Benign: people tend to befriend me
15. reject you the people accept new
Social anxiety: new people reject the new you

Benign: new people accept the new you
16. sabotaging tried supporting others me have
Paranoia: others have tried sabotaging me

Benign: others have tried supporting me
17. tedious people your-work think outstanding is
Social anxiety: people think your-work is tedious

Benign: people think your-work is outstanding
18. to me follow policemen protect try
Paranoia: policemen try to follow me

Benign: policemen try to protect me
19. attracted you people repelled by are
Social anxiety: people are repelled by you

Benign: people are attracted by you
20. can security me catch cameras safeguard
Paranoia: security cameras can catch me

Benign: security cameras can safeguard me

In the spaces above, write down the number you learned, or as much as you can remember of it.

21. rarely friends me out always ask
Social anxiety: friends rarely ask me out

Benign: friends always ask me out
22. me single out others help frequently
Paranoia: others frequently single me out

Benign: others frequently help me out

23. boring new acquaintances find me entertaining
Social anxiety: new acquaintances find me boring

Benign: new acquaintances find me entertaining
24. watch me store normally assistants help
Paranoia: store assistants normally watch me

Benign: store assistants normally assistants me
25. inappropriately I'm guests think dressed appropriately
Social anxiety: guests think I'm dressed inappropriately

Benign: guests think I'm dressed appropriately
26. implicate me strangers' normally disregard conversations
Paranoia: strangers' conversations normally disregard me

Benign: strangers' conversations normally implicate me
27. neighbour of my me approves disapproves
Social anxiety: my neighbour disapproves of me

Benign: my neighbour approves of me
28. like to flatter me belittle friends
Paranoia: friends like to belittle me

Benign: friends like to flatter me
29. I sure sound myself unsure of
Social anxiety: I sound unsure of myself

Benign: I sound sure of myself
30. relaxed I to observed tend feel
Paranoia: I tend to feel observed

Benign: I tend to feel relaxed
31. I many unpleasant comments pleasant receive
Social anxiety: I receive many unpleasant comments

Benign: I receive many pleasant comments
32. on watched I comfortable trains feel
Paranoia: I feel watched on trains

Benign: I feel comfortable on trains

33. people listen absently to attentively me
Social anxiety: people absently listen to me

Benign: people attentively listen to me
34. at strangers point wave me often
Paranoia: strangers often point at me

Benign: strangers often wave at me
35. my friends helpful advice useless find
Social anxiety: friends find my advice useless

Benign: friends find my advice helpful
36. approvingly strangers at look me critically
Paranoia: strangers look at me critically

Benign: strangers look at me approvingly
37. my-clothes friends outdated think fashionable are
Social anxiety: friends think my-clothes are outdated

Benign: friends think my-clothes are fashionable
38. envy people my support ideas other
Paranoia: other people envy my ideas

Benign: other people support my ideas
39. at mistakes everyone jokes laughs my
Social anxiety: everyone laughs at my jokes

Benign: everyone laughs at my mistakes
40. rumors about me others compliments pass
Paranoia: others pass rumors about me

Benign: others pass compliments about me

In the spaces above, write down the number you learned, or as much as you can remember of it.

Appendix 3. Word-sentence association paradigm Version 1

and 2 items

Version 1- Social anxiety related items (55 items)

Experiment 1, 3, 4, & 5

Words

Sentences

Benign

Negative

1. Well-Liked	Disliked	A friend comments on your music choice for the party
2. Attractive	Ugly	An old friend comments on how you look different now
3. Intelligent	Dumb	People judge the speech you just gave
4. Glamorous	Hideous	Someone comments on your new outfit at a party
5. Cool	Weird	Someone looks at you as you walk by
6. Admire	Pity	Someone you like says hello to you
7. Clever	Dense	You are asked to contribute your ideas for a group project
8. Cute	Embarrassing	You blush when someone smiles at you
9. Respected	Mocked	You hear your name mentioned in a nearby conversation
10. Enchanting	Boring	You make a first impression on your new co-worker
11. Praise	Criticize	Your boss wants to meet with you
12. Helpful	Unhelpful	You give advice to a friend
13. Nice	Terrible	Your friend comments on your new haircut
14. Impressed	Aghast	The audience is surprised at the speech you gave
15. Fantastic	Disaster	Friends thought your Christmas party turned out different from last year

16. Bewitching	Tedious	A friend sets you up on a blind date
17. Captivating	Dull	Your interviewer comments later on your performance
18. Beautiful	Unsightly	People saw you playing at the beach
19. Graceful	Clumsy	You handle the ball in a baseball game
20. Distinction	Fail	Your tutor wants to talk to you about your essay
21. Lovely	Dowdy	Your friend comments on your graduation pictures
22. Comfortable	Nervous	You stand up to introduce yourself at a meeting
23. Commitment	Breakup	Your partner wants to talk about your relationship
24. Well-liked	Disliked	Your friends are surprised at your painting
25. Respected	Mocked	Everyone stops talking when you enter the room
26. Graceful	Clumsy	You handle the ball in a baseball game
27. Attractive	Ugly	You just got your yearbook pictures back
28. Respected	Mocked	A coworker begins saying the same phrases you do
29. Distracted	Mad	A friend does not respond when you wave hello
30. Cool	Weird	Colleagues found your views unusual
31. Professional	Unimpressed	In an interview the people do not smile
32. Smart	Stupid	People believe you have to think about stuff for a long time
33. Funny	Embarrassing	People laugh after something you said
34. Admire	Pity	Someone introduces themselves to you
35. Graceful	Clumsy	Someone you do not know asks you to dance
36. Distracted	Mad	While returning a jacket the clerk is abrupt
37. Good-looking	Hideous	You are on a first date
38. Smile	Look away	You are standing next to an attractive person
39. Clever	Dense	You ask for assistance from you professor

40. Graceful	Clumsy	You carry a tray of food at a party
41. Smart	Stupid	You think harder than others during an intelligence test
42. Well-liked	Disliked	You have to throw a party for the office
43. Smart	Stupid	You just finished taking an oral exam
44. Cool	Weird	You laugh differently than other people
45. Good-looking	Hideous	You notice someone pointing in your direction
46. Accepted	Rejection	You receive a call from a company you interviewed with
47. Clever	Dense	You share an idea with someone
48. Calm	Worried	Your advisor examines your schedule for next year
49. Success	Disaster	Your classmates are surprised by your project
50. Busy	Bored	Your date has to leave early
51. Happy	Disappointed	Your friend opens your present and makes a face
52. Captivating	Boring	Your friends think of you differently after a long road trip
53. Praise	Criticize	Your parents talk to you about your grades
54. Excited	Panicky	Your picture is going to be in the newspaper
55. Praise	Criticize	Your teacher wrote many comments on your essay

Version 1- Paranoia related items (55 items)

Experiment 1, 3, 4, & 5

Words

Sentences

Benign

Paranoid

1. Greeting	Threatening	Someone moves toward you while raising their hand.
2. Acquaintance	Mugger	You can hear someone running up from behind.
3. Friendly	Aggressive	A stranger comes up to you in the street.

4. Gift	Bomb	A man put a box outside your door and quickly left.
5. Drink	Hit	The strength of your friend's punch took you by surprise.
6. Forgetful	Plotting	At work you find out that the team you lead has had a meeting without you.
7. Joking	Aggression	Your brother is walking towards you with a strange expression on his face.
8. Kindness	Poison	A stranger offers you some coffee.
9. Respected	Mocking	Everyone stops talking when you enter the room
10. Welcoming	Unwelcome	The group discussion suddenly stops when you join them.
11. Attentive	Irritated	Your waiter keeps looking over at your table during dinner.
12. Appreciated	Persecuted	You overhear your name when colleagues' are talking
13. Adored	Leering	A stranger gets on board the bus and appears to turn around and look at you several times.
14. Praised	Scheming	Whilst at the bar you notice your friends are talking and looking in your direction.
15. Meeting	Snooping	On returning to your car you notice a man standing nearby.
16.		You haven't received a party invitation from a friend.
17. Forgotten	Ignored	A classmate bumped into you when you were entering the classroom
18. Funny	Intentional	Your friend immediately turns to talk to another guy after you tell them something
19. Interrupted	Betrayed	Someone has been walking behind you for two blocks
20. Neighbor	Following	A strong man sits next to you on the flight
21. Athlete	Terrorist	
22. Full	Mean	At the hotel you are given a shared room although you booked a private one
23. Attracted	Monitoring	A colleague frequently passes your desk these days
24. Concerned	Envious	You catch your friend with their eyes on your partner
25. Delivery	Surveillance	A van was parked outside your house yesterday
26. Calm	Trap	Your interviewer is leading you to a small closed room
27. Amusing	Aggravation	The people walking behind you are constantly raising their voices
28. Rushed	Thug	A stranger bumped into you and left without apologizing

29. Congestion	Pursue	The same car has been behind you for a long time now
30. Surprise	Trap	You received a parcel with no information of who sent it
31. Fair	Penalize	Your supervisor gave you a low score but gave your classmate a higher one
32. Clever	Undermining	A colleague frequently challenges your points in a meeting
33. Urgent	Hostile	Someone is knocking loudly on the door of your house
34. Protect	Assault	A stranger suddenly puts his hand on your shoulder
35. Interested	Sabotage	One person asked several difficult questions during your presentation
36. Flower	Weapon	The person walking towards you is hiding something under his clothes
37. Curious	Sinister	The man in the car next to you looks at you
38. Admire	Set Up	Someone you do not know asks you to dance
39. Idea	Raid	A colleague suddenly runs into your office
40. Attracted	Spying	You're at a party and notice that a stranger is looking in your direction
41. Intimate	Infecting	Your colleague stands very close to you even though they have a cold.
42. Relaxing	Harmful	You feel sleepy occasionally after taking the medication your doctor has given you
43. Kind	Suspicious	A classmate offers you some snacks without eating them themselves
44. Kind	Noxious	You are offered a glass of wine by stranger
45. Introduction	Attack	A man gets up out of his seat and moves towards you
46. Mistake	Confrontation	You spill your drink over a very large man and he gets up from his seat
47. Borrowed	Stolen	You cannot find your favorite shirt
48. Summer	Burglar	Your front door is open
49. Bank	Stolen	Your money is not here
50. Fireworks	Robber	You hear a loud noise at night
51. Sports	Fight	You and your partner start yelling
52. Sleepover	Kidnapped	Your child does not sleep at home tonight
53. Playing	Killed	Your dog does not return home

54. Family	Stranger	You hear a rustling noise on the second floor
55. Mistake	Angry	A colleague leaves your office and the door slams

Version 2- Social anxiety related items (55 items)

Experiment 1, 3, & 4

Words		Sentences
Benign	Negative	
1. Thoughtful	Jumbled	People are confused by your opinions
2. Entertaining	Foolish	People at the wedding laugh at your toast
3. Confident	Shy	People judge the speech you just gave
4. Joke	Opinion	People laugh after something you said
5. Attractive	Strange	People stare at you at a restaurant
6. Good-looking	Foolish	People stare at you while you shop
7. Calm	Nervous	You are on a first date
8. Organized	Lazy	You have been asked to take on a new responsibility at work
9. Funny	Derogatory	You hear a friend make a joke about you
10. Valued	Offended	You hear your name mentioned in a nearby conversation
11. Politely	Irksome	You make small talk with people at a wedding reception
12. Dedicated	Tedious	You notice a group of your peers watching you work
13. Acceptance	Rejection	You receive a call from a company that interviewed you
14. Noticed	Ridicule	You see an attractive person looking at you in the store
15. Brilliant	Stupid	You share an idea with someone
16. Busy	Angry	Your boss ignores your input
17. Friendly	Desperate	Your friend asks you to go to a party
18. Opportunity	Unsuccessful	Your career advisor wants to meet with you

19. Vacation	Rejection	Your friend does not return your call
20. Wonderful	Uninspired	Your friends are surprised at your painting
21. Committed	Difficulty	Your partner wants to talk about your relationship
22. Dance	Concerned	Your friend asks you to go to a party
23. Good	Poor	An interviewer tells you your chances of being offered the job
24. Keen	Slow	Your manager comments on your first day at the new job
25. Exciting	Immaterial	Your boss comments on your ideas in the discussion.
26. Ill	Annoyed	Your brother cancels your trip after you argued with him
27. Unwell	Disinterested	Your friend postpones your lunch date
28. Skilled	Lousy	Your tennis partner discusses your performance in the match
29. Forgetful	Disinterested	Your friend does not call you back
30. Commitment	Breakup	Your partner wants to talk about your relationship
31. Skilful	Incompetent	Your work is being closely observed.
32. Entertain	Ridicule	Your presentation made the class laugh.
33. Attraction	Repulsion	A friend finds it hard to disguise their feelings for you.
34. Pleasure	Horror	Your friends are surprised at your painting
35. Forgetful	Desertion	A flat mate did not leave you a note when they left.
36. Compliment	Complaint	A customer comes back to speak to you
37. Comfortable	Uncomfortable	A friend sets you up on a blind date
38. Funny	Embarrassing	You and a classmate accidentally bump into each other
39. Friendly	Refused	You offer an acquaintance some coffee
40. Success	Fail	You are unsure of your test score
41. Impressive	Disaster	You have to write an essay about your life's achievements
42. Greet	Avoid	You see a group of people approaching
43. Comfortable	Uncomfortable	You stand up to introduce yourself at a meeting

44. Careful	Confused	You take a long time to reply to peoples' questions
45. Helpful	Scary	Your career advisor wants to meet with you
46. Wide	None	You think about your circle of friends
47. Late	Abandoned	Your date is not here yet
48. Vacation	Rejected	Your friend does not return your call
49. Comfortable	Uncomfortable	Your teacher calls on you to answer
50. Shy	Outgoing	You are at a party with a friend
51. Excited	Cancel	You are going to a meeting and feel jittery
52. Fun	Avoid	You are invited to a party
53. Funny	Embarrassing	You spill a little water on your shirt at dinner
54. Enjoyment	Go home	You start to sweat at a party
55. Praise	Reprimand	Your boss calls you into his office

Version 2- Paranoia related items (55 items)

Experiment 1, 3, & 4

Words		Sentences
Benign	Paranoid	
1. Reconcile	Humiliate	A colleague who you quarreled with asks you to dinner
2. Date	Stalker	Someone has been standing in front of your door for long time
3. Admire	Thief	Someone on the bus glances frequently at your bag
4. Tired	Provoke	A colleague is frequently bickering with you.
5. Crowded	Intimidate	A strong man stands very close to you at the bus stop
6. Vacant	Suspicious	Someone in a house stares at you when you are passing by
7. Care	Invasive	The bank clerk asks some very personal questions
8. Friendly	Inappropriate	A stranger on the bus asks for your phone number

9. Cleaner	Intrusion	Things on your desk have been moved
10. Spice	Spiked	Someone in the pub buys you a drink that tastes different
11. Busy	Provoked	You are kept waiting for your appointment to start
12. Surplus	Cheated	A shop assistant gave you the wrong amount of change
13. Unlucky	Tricked	At a party none of the friends who invited you were there
14. Crowded	Spiteful	The check-in clerk gave you a bad seat on the flight
15. Admiring	Surveillance	You saw a stranger standing looking in at your window
16. Emergency	Vindictive	The cashier let someone behind you in the queue go first
17. Accidental	Pinch	A stranger is sitting on your chair when you go back to your seat in the library
18. Friendly	Aggressive	Someone smacked your shoulder from behind
19. Lost	Stolen	You cannot find your car in the parking area
20. Postman	Bomber	Someone walks toward your door with a package in their hand
21. Attraction	Imperil	People stare at you in a restaurant
22. Beautiful	Intimidate	People stare at you while you are shopping yourself
23. Kindness	Trap	Someone you do not know asks you out for a drink
24. Sinister	Traffic	The car behind you is following closely
25. Attractive	Watching	The man in the library next to you looks at you
26. Playing	Abducted	You cannot find your young sister
27. Passing	Defiant	You see a group of teenagers approaching
28. Wallet	Stolen	You can't find your money in your pocket
29. Celebrate	Murder	There are a lot of people crowded around the bar
30. Van	Shot	You hear a noise outside your window
31. Party	Ransom	Your partner does not sleep at home tonight
32. School	Abducted	Your child is not home when you wake up
33. Coincidence	Thief	Someone just passes you holding a wallet like yours

34. Squashed	Thief	You feel someone is touching your bag
35. Accident	Targeted	A basketball just misses hitting you on the head
36. Suspicious	Acquaintance	You notice a man looking at you from across the street
37. Drunk	Doped	You feel strange after drinking the wine an acquaintance bought you
38. Traffic jam	Stalker	You notice the same car behind you in your rear view window
39. Intruder	Visitor	You hear movement as footsteps approach the front door
40. Assistance	Harassment	Your colleague calls you three times one evening
41. Busy	Bully	Someone blocks your way
42. Colleague	Intruder	Someone is shouting from your office
43. Kind	Risky	A stranger asks you for a drink
44. Deaf	Aggressive	Your roommate calls you loudly
45. Disease	Abuse	Your dog becomes very thin while you are away
46. Mistake	Bully	You receive an call from a stranger
47. Windy	Stolen	The clothes you hung to dry in the garden have disappeared
48. Dog	Pinched	Half of your snacks on the table were eaten
49. Friend	Fraud	You receive a phone message asking for money
50. Unseen	Deliberate	The bus does not stop for you although you wave your hand
51. Jogging	Assailant	Someone is running toward you on the path in the park
52. Typo	Hacker	You cannot log into your laptop with your password
53. Misaid	Swiped	You cannot find your phone when you are shopping in the market
54. Healthy	Negligent	The doctor sends you home without giving any medicine
55. Friendly	Drugged	You are offered some coffee by a new acquaintance

Appendix 4. The Relatedness Judgment Task items (26

items)

Experiment 2

1

**Two of your coworkers are
talking about something....**



**A. They are plotting
against me**

**B. They are criticising
me**

1

2

**You see a man looking at you
across the street...**



**A. He thinks I look
awful**

B. He is stalking me

2

3

**Your friends start laughing as
soon as you leave the table...**



**A. They are talking
about my faults**

**B. They are planning
something against
me**

3

4

Your colleague does not respond to your questions...



A. She is deliberately trying to hurt me

B. She is not interested in what I have to say

4

5

You're on a bus and someone keeps staring at you



A. He is planning something threatening

B. He thinks I look bad

5

6

At your party your friends leave early..



A. They are deliberately trying to hurt me

B. They find my party boring

6

7

You have been waiting for your date to arrive for quite some time...



A. Others around must think I look pathetic

B. They have deliberately stood me up

7

A stranger asks you to dance...



- A. They will think I am a bad dancer
- B. They have bad intentions

8

benign? Your date keeps looking at their phone...



- A. They are gossiping about me to their friends
- B. They find me uninteresting

9

10

You pass your office mates in the corridor...



A. They are discussing something that will undermine my work

B. They are discussing my faults as a person

10

11

You notice two of your friends looking at you and laughing...



A. They think my outfit is awful

B. They are spreading rumors about me

11

12

A woman blocks your way in the supermarket ...



A. She is doing it deliberately

B. She thinks I am a waste of space

12

13

You're out with your new partner when a friend walks by...



A. They will sabotage my new relationship

B. They think I am pathetic

13

14

**You are having an argument with
your colleague...**



**A. They are
disapproving of me**

**B. They are hostile
towards me**

14

15

**Your partner does not come
home tonight...**



**A. My partner is
cheating on me**

**B. My partner must be
bored with me**

15

16

You disclose something to your friend...



- A. They will judge me**
- B. They will use this against me**

16

17

You're talking to someone you're interested in but they switch their attention to others....



- **A. The person is trying to hurt me**
- B. The person thinks I am unattractive**

17

18

You present your ideas to your colleagues...



- A. They might use my ideas as their own**
- B. They think my ideas are useless**

18

19

Main? You are supposed to meet a friend but they are not answering your call...



- A. They are trying to get rid of me**
- B. They have made other plans without me**

19

20

Main? Two of your managers are having a discussion following your proposal...



- A. They are planning to fire me**
- B. They are disappointed with my performance**

20

21

In the library a stranger starts to talk to me...



- A. She is just being friendly**
- B. She is judging what I am reading**
- C. She has bad intentions towards me**

21

22

You are on a bus and no one sits next to you...



- A. Other passengers notice the seat is broken
- B. Other passengers think I smell bad
- C. Other passengers are hostile towards me

22

23

A group of women are looking in your direction and laughing...



- A. They are gossiping about me
- B. They think I look awful
- C. They like your gym wears

23

24

The couple sitting next to you stare at you...



- A. They think I look bad
- B. They are gossiping about me
- C. They are interested in my new haircut**

24

25

You are having an argument with your flat mate...



- A. She is threatening to throw me out
- B. I must have let her down
- C. You just don't like each other**

25

You find a dog and a cat are fighting with each other in your neighbor's garden



- A. The cat wins**
- B. The dog wins**
- C. They end up friends**

Appendix 5. Ethics approval letters

Experiment 1, 3, & 4

Yuanyuan Huo
Institute of Psychiatry
PO63
De Crespigny Park
SE5 8AF

11 May 2011

Dear Yuanyuan,

PNM/10/11-62 Distinguishing social anxiety from paranoia: testing the aetiological role of interpretative biases.

Thank you for sending in the amendments requested to the above project. I am pleased to inform you that these meet the requirements of the PNM RESC and therefore that full approval is now granted.

Please ensure that you follow all relevant guidance as laid out in the King's College London Guidelines on Good Practice in Academic Research (<http://www.kcl.ac.uk/college/policyzone/index.php?id=247>).

For your information ethical approval is granted until 11 May 2014. If you need approval beyond this point you will need to apply for an extension to approval at least two weeks prior to this explaining why the extension is needed, (please note however that a full re-application will not be necessary unless the protocol has changed). You should also note that if your approval is for one year, you will not be sent a reminder when it is due to lapse.

If you do not start the project within three months of this letter please contact the Research Ethics Office. Should you need to modify the project or request an extension to approval you will need approval for this and should follow the guidance relating to modifying approved applications: <http://www.kcl.ac.uk/research/ethics/applicants/modifications.html>

Any unforeseen ethical problems arising during the course of the project should be reported to the approving committee/panel. In the event of an untoward event or an adverse reaction a full report must be made to the Chairman of the approving committee/review panel within one week of the incident.

Please would you also note that we may, for the purposes of audit, contact you from time to time to ascertain the status of your research.

If you have any query about any aspect of this ethical approval, please contact your panel/committee administrator in the first instance (<http://www.kcl.ac.uk/research/ethics/contacts.html>). We wish you every success with this work.

With best wishes

Yours sincerely

James Patterson - Senior Research Ethics Officer
For and on behalf of
Professor Gareth Barker, Chairman
Psychiatry, Nursing & Midwifery Research Ethics Subcommittee

Cc: Jenny Yiend

Experiment 2

Yuanyuan Huo
PO 63
Institute of Psychiatry
Kings College London
De Crespigny Park
London
SE5 8AF

07 October 2011

Dear Yuanyuan

PNM/10/11-62 Distinguishing social anxiety from paranoia: Testing the aetiological role of interpretative biases.

Thank you for submitting a modification request for the above study. I am writing to confirm approval of this. The modifications and proviso regarding this request are summarised below:

1. The duration of the testing session will be one hour.
2. There are content changes to The Scrambled Sentence Task and the Similarity Rating Task. The Word Sentence Related Task will be replaced by a picture task: The Relatedness Judgement Task.
3. The Scrambled Sentence Task and the Similarity Rating Task have been adapted by juxtaposing social anxiety with a paranoid interpretation in the task.
4. Participants will receive £7 as compensation for their time.
5. You will inform the Research Ethics office of additional researchers in due course.

If you should have any further queries about your application, please do not hesitate to contact the Research Ethics office.

Yours sincerely

Catherine Fieulleateau
Senior Research Ethics Officer

cc: Dr Jenny Yield

Experiment

5



Health Research Authority

NRES Committee London - Westminster

Level 3, Block B,
Whitefriars

Lewins Mead
Bristol

BS1 2NT

Telephone: 01173421336

19 June 2014

Ms Yuanyuan Huo
Institute of Psychiatry
M7.08.01A
Institute of Psychiatry
De Crespigny Park
SE5 8AF

Dear Ms Huo

Study title:	Distinguishing Social Anxiety from Paranoia: Testing the Aetiological Role of Interpretative Biases
REC reference:	14/LO/0772
IRAS project ID:	92347

Thank you for your letter of responding to the Committee's request for further information on the above research and submitting revised documentation.

The further information has been considered on behalf of the Committee by the Chair.

We plan to publish your research summary wording for the above study on the HRA website, together with your contact details. Publication will be no earlier than three months from the date of this opinion letter. Should you wish to provide a substitute contact point, require further information, or wish to make a request to postpone publication, please contact the REC Manager, nrescommittee.london-westminster@nhs.net.

Confirmation of ethical opinion

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation as revised, subject to the conditions specified below.

Conditions of the favourable opinion

The favourable opinion is subject to the following conditions being met prior to the start of the study.

Research Ethics Committee established by the Health Research Authority

You should notify the REC in writing once all conditions have been met (except for site approvals from host organisations) and provide copies of any revised documentation with updated version numbers. The REC will acknowledge receipt and provide a final list of the approved documentation for the study, which can be made available to host organisations to facilitate their permission for the study. Failure to provide the final versions to the REC may cause delay in obtaining permissions.

Management permission or approval must be obtained from each host organisation prior to the start of the study at the site concerned.

Management permission ("R&D approval") should be sought from all NHS organisations involved in the study in accordance with NHS research governance arrangements.

Guidance on applying for NHS permission for research is available in the Integrated Research Application System or at <http://www.rdforum.nhs.uk>.

Where a NHS organisation's role in the study is limited to identifying and referring potential participants to research sites ("participant identification centre"), guidance should be sought from the R&D office on the information it requires to give permission for this activity.

For non-NHS sites, site management permission should be obtained in accordance with the procedures of the relevant host organisation.

Sponsors are not required to notify the Committee of approvals from host organisations

Registration of Clinical Trials

All clinical trials (defined as the first four categories on the IRAS filter page) must be registered on a publically accessible database within 6 weeks of recruitment of the first participant (for medical device studies, within the timeline determined by the current registration and publication trees).

There is no requirement to separately notify the REC but you should do so at the earliest opportunity e.g when submitting an amendment. We will audit the registration details as part of the annual progress reporting process.

To ensure transparency in research, we strongly recommend that all research is registered but for non clinical trials this is not currently mandatory.

If a sponsor wishes to contest the need for registration they should contact Catherine Blewett (catherineblewett@nhs.net), the HRA does not, however, expect exceptions to be made. Guidance on where to register is provided within IRAS.

It is the responsibility of the sponsor to ensure that all the conditions are complied with before the start of the study or its initiation at a particular site (as applicable).

Ethical review of research sites

NHS sites

Research Ethics Committee established by the Health Research Authority

The favourable opinion applies to all NHS sites taking part in the study, subject to management permission being obtained from the NHS/HSC R&D office prior to the start of the study (see "Conditions of the favourable opinion" below).

Approved documents

The final list of documents reviewed and approved by the Committee is as follows:

Document	Version	Date
Copies of advertisement materials for research participants - Leaflet for anxious patient	1	16 April 2014
Copies of advertisement materials for research participants - poster	1	16 April 2014
Copies of advertisement materials for research participants email to health volunteers	1	16 April 2014
Evidence of Sponsor insurance or indemnity (non NHS Sponsors only)		17 July 2013
Non-validated questionnaire [G-PTS]	1	16 April 2014
Other [Supervisor's CV]		01 January 2013
Other [Supervisor's CV]		23 April 2014
Other [Response to REC provisional letter_version1]	1	04 June 2014
Participant consent form [Participant consent form for healthy_v2]	2	04 June 2014
Participant consent form [Participant consent form for patient_v2]	2	04 June 2014
Participant information sheet (PIS) [Participant information sheet for patient (Psychosis-paranoid)_v2]	2	04 June 2014
Participant information sheet (PIS) [Participant information sheet for patient (social anxiety)_v2]	2	04 June 2014
Participant information sheet (PIS) [Participant information sheet for patient (Psychosis-nonparanoid)_v1]	2	04 June 2014
Participant information sheet (PIS) [Participant information sheet for healthy controls_v2]	2	04 June 2014
REC Application Form		22 April 2014
Referee's report or other scientific critique report		23 April 2014
Research protocol or project proposal	1	16 April 2014
Summary CV for Chief Investigator (CI)		16 April 2014
Validated questionnaire [PDI]	1	16 April 2014
Validated questionnaire [PS]	1	16 April 2014
Validated questionnaire [SPS]	1	16 April 2014
Validated questionnaire [SIAS]	1	16 April 2014
Validated questionnaire [LSAS]	1	16 April 2014

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

Research Ethics Committee established by the Health Research Authority

After ethical review

Reporting requirements

The attached document "*After ethical review – guidance for researchers*" gives detailed guidance on reporting requirements for studies with a favourable opinion, including:

- Notifying substantial amendments
- Adding new sites and investigators
- Notification of serious breaches of the protocol
- Progress and safety reports
- Notifying the end of the study

The HRA website also provides guidance on these topics, which is updated in the light of changes in reporting requirements or procedures.

Feedback

You are invited to give your view of the service that you have received from the National Research Ethics Service and the application procedure. If you wish to make your views known please use the feedback form available on the HRA website:

<http://www.hra.nhs.uk/about-the-hra/governance/quality-assurance/>

We are pleased to welcome researchers and R & D staff at our NRES committee members' training days – see details at <http://www.hra.nhs.uk/hra-training/>

14/LO/0772

Please quote this number on all correspondence

With the Committee's best wishes for the success of this project.

Yours sincerely



Dr Alan Ruben
Chair

Email: nrescommittee.london-westminster@nhs.net

Enclosures:

"After ethical review – guidance for researchers" [

Copy to:

Keith Brennan

Jennifer Liebscher, South London and Maudsley NHS Foundation Trust

Appendix 6. Information sheet

Experiment 1, 3, & 4

INFORMATION SHEET FOR PARTICIPANTS

REC Reference Number: [PNM/10/11-62]

YOU WILL BE GIVEN A COPY OF THIS INFORMATION SHEET



Individual Differences in Interpretation Styles

We would like to invite you to participate in this postgraduate research project. You should only participate if you want to; choosing not to take part will not disadvantage you in any way. Before you decide whether you want to take part, it is important for you to understand why this research is being done and what your participation will involve. Please take time to read the following information carefully and discuss it with others if you wish. Feel free to contact us if there is anything that is not clear or if you would like more information.

Current theories of cognitive processing specifically target the way people explain information. We would like to find out the different ways individuals understand, explain and respond to everyday information. We are also interested in how these processes relate to each other. For example, whether there are strong links between thinking styles and mood. If so, therapies may be improved and become more effective. We also hope our findings from this study may contribute to the establishment of a model of how people process information, and strengthen understanding of variations in thinking style and help therapies more successfully address them.

Who do we need for this study?

Participants for this study only need to meet the four criteria below.

1. **Over 18 years old**
 2. **Can speak fluent English**
 3. **Have not been diagnosed with any psychological or psychiatric problem(s), or not currently receiving treatment for any psychological or psychiatric problem(s); and not taking any psychological or psychiatric medication (this does not include medications for general health concerns).**
 4. **Available for 2 testing sessions 6 months apart.**
(Please think carefully about whether you will be available in 6 months time, because we cannot use any of your data unless you attend BOTH sessions.)
- If you are eligible and interested to participate, you will be given a copy of this information sheet to keep and will be asked to sign a consent form.

What procedures does your participation involve?

1. Questionnaires

"If you meet the criteria described above and decide to participate, please complete and return the attached questionnaire. We may then contact you to invite you to take part in the main study. You are free to decline our invitation. If you are not approached to take part in the study we will deal with your data according to the check boxes provided on the screening questionnaire. There you are asked to indicate 1) whether or not you consent for us to keep & use your contact details (name, email, mobile and postal address) in case of further studies and 2) whether or not you consent for us to keep & use your data so that we can report statistics on recruitment to the current study (demographic information and current mood)."

If you are contacted about taking part you will be asked to participate in both sessions described below. Even if you agree to participate, you are still free to withdraw at any point during any session.

2. Session 1

If you decide to participate, you will be asked to:

- Judge whether certain words are related to a series of sentences. First, a word will be presented followed by a sentence. You will then judge if whether that word is related to the sentence (This task is computer-based).
- Make sensible sentences from a list of mixed up words. You will reorder five out of six scrambled words to produce grammatically correct sentences.
- Read a series of passages of text and rate a series of answers related to the passages. These passages reflect a variety of situations commonly experienced (This task is computer-based).
- Complete personality questionnaires about yourself at the end of the session.

3. Session 2

You will be asked to complete exactly the same procedures as Session 1:

- Judge whether certain words are related to a series of sentences. First, a word will be presented followed by a sentence. You will then judge if whether that word is related to the sentence (This task is computer-based).
 - Make sensible sentences from a list of mixed up words. You will reorder five out of six scrambled words to produce grammatically correct sentences.
 - Read a series of passages of text and rate a series of answers related to the passages. These passages reflect a variety of situations commonly experienced (This task is computer-based).
 - Complete personality questionnaires about yourself at the end of the session.
- Please note that all the above tasks are paper and pen, unless specifically stated otherwise.
- Following completion of session 1, participation of session 2 will be arranged for 6 months time. Please note that we hope you could attend both sessions, otherwise we cannot use your data for the research.

Where will our experiment be conducted and how long will it take?

Sessions will take place in dedicated testing rooms in the main building, Institute of Psychiatry, Kings College (16 De Crespigny Park, SE5 8AF). Each session will take approximately 1½ hours. You will be paid £20 in total to compensate for your time and travel expenses.

What are the benefits of participation?

There are no direct benefits to you. We hope that results of this study will contribute to the understanding and ongoing development of psychologically based theory and therapies.

What are the risks of participation?

There is a very slight chance that you may find some of the words & passages in the tasks or questionnaires upsetting or unpleasant. If you do, the researcher can stop the session immediately, or you can choose to move onto a different item. You also can contact researchers if you feel any upset after the session. Please note you have the right to decline or withdraw from the study at any point without reason or penalty.

Will I get any support?

In case you need any support or help, we provide all those who respond with a list of supportive organizations including useful resources which refer you to other organizations where you can receive help. Also, if this study has harmed you in any way you can contact King's College London using the details below for further advice and information.

Will my data remain anonymous?

All information you tell us will remain completely confidential within the limits of the law, whether or not you finished the experiment procedures. An identification number will be used to substitute your name on all personal data to ensure anonymity. You may withdraw your data from the project at any time up until it is transcribed for use in the final report.

- It is up to you to decide whether to take part or not. If you decide to take part you are still free to withdraw at any time and without giving a reason.
- If you agree to take part you will be asked whether you are willing to be contacted about participation in future studies. Your participation in this study will not be affected should you choose not to be recontacted.

Thank you for reading this letter. We hope you can participate in this study. Meanwhile, if you have any questions, please feel free to contact me by email, yuanhuan.huo@kcl.ac.uk.

Sincerely,

Yuanhuan Huo
Mphil.PhD student
yuanhuan.huo@kcl.ac.uk
Tel. 020 7848 0512

Dr. Jenny Yiend
Programme Director, Mental Health Studies Programme
Jenny.yiend@kcl.ac.uk

Sources of help, information and support inside the UK

- **In a crisis**

If you are having a crisis contact The Samaritans.
Tel: 08457 909090, or visit the web site.

- **Violence**

If you or anyone else is in immediate danger of physical harm contact the police.
The police are generally very sympathetic to issues of mental illness.
Dial 999 to contact the police in an emergency.

- **NHS Direct**

NHS Direct operates a 24-hour nurse advice and health information service, providing confidential information on:

- What to do if you or your family are feeling ill.
- Particular health conditions.
- Local healthcare services, such as doctors, dentists or late night opening pharmacies.
- Self help and support organisations.

The telephone number is 08454647. The service is available in England and Wales and a similar service called NHS24 is available in Scotland or by calling 084542424 24.

- **SANELINE**

SANELINE is the only national, out of hours, mental health helpline providing support and information to anyone coping with mental illness. It is open every day of the year from 6pm until 11pm on lo-call number 0845 767 8000.

SANELINE offers emotional support, crisis care and detailed information to people experiencing mental health problems, their families carers, health and other professionals, and all organisations dealing with people affected by mental illness.

For more information please visit www.sane.org.uk

- **Rethink services National Advice Service**

Rethink's National Advice Service provides advice about schizophrenia, bipolar disorder and other mental illness as well as related issues including legal rights and benefits. Call 0845 456 0455 weekdays between 10am and 2pm or e-mail: advice@rethink.org

Rethink, the leading severe mental illness charity, works to help everyone affected by mental illnesses such as schizophrenia and bipolar disorder to recover a better quality of life. We provide hope and empowerment through effective services and support to all those who need us. We also campaign for change through greater awareness and understanding.

Rethink is the largest national voluntary sector provider of mental health services. Our wide range of services includes advocacy, carer support, community support, employment and training, helplines, housing, nursing and residential care and services dedicated to black and minority ethnic

communities. Visit Rethink's website for information about mental illnesses such as schizophrenia and bipolar disorder, and how we help everyone affected by them.

(Rethink were formerly known as the National Schizophrenia Fellowship.)

- **Also see link: <http://www.mentalhealthcare.org.uk/>**

Experiment 2

INFORMATION SHEET FOR PARTICIPANTS

REC Reference Number: [PNM/10/11-62]



YOU WILL BE GIVEN A COPY OF THIS INFORMATION SHEET

Individual Differences in Interpretation Styles

We would like to invite you to participate in this postgraduate research project. You should only participate if you want to; choosing not to take part will not disadvantage you in any way. Before you decide whether you want to take part, it is important for you to understand why this research is being done and what your participation will involve. Please take time to read the following information carefully and discuss it with others if you wish. Feel free to contact us if there is anything that is not clear or if you would like more information.

Current theories of cognitive processing specifically target the way people explain information. We would like to find out the different ways individuals understand, explain and respond to everyday information. We are also interested in how these processes relate to each other. For example, whether there are strong links between thinking styles and mood. If so, therapies may be improved and become more effective. We also hope our findings from this study may contribute to the establishment of a model of how people process information, and strengthen understanding of variations in thinking style and help therapies more successfully address them.

Who do we need for this study?

Participants for this study only need to meet the four criteria below.

5. **Over 18 years old**
 6. **Can speak fluent English**
 7. **Have not been diagnosed with any psychological or psychiatric problem(s), or not currently receiving treatment for any psychological or psychiatric problem(s); and not taking any psychological or psychiatric medication (this does not include medications for general health concerns).**
- If you are eligible and interested to participate, you will be given a copy of this information sheet to keep and will be asked to sign a consent form.

What procedures does your participation involve?

4. Questionnaires

"If you meet the criteria described above and decide to participate, please complete and return the attached questionnaire. We may then contact you to invite you to take part in the main

study. You are free to decline our invitation. If you are not approached to take part in the study we will deal with your data according to the check boxes provided on the screening questionnaire. There you are asked to indicate 1) whether or not you consent for us to keep & use your contact details (name, email, mobile and postal address) in case of further studies and 2) whether or not you consent for us to keep & use your data so that we can report statistics on recruitment to the current study (demographic information and current mood)."

If you are contacted about taking part you will be asked to participate in the testing session described below. Even if you agree to participate, you are still free to withdraw at any point during any session.

5. During the testing session

If you decide to participate, you will be asked to:

- Judge whether certain pictures are related to a series of sentences. First, a picture will be presented followed by a sentence. You will then judge if whether that picture is related to the sentence (This task is computer-based).
- Make sensible sentences from a list of mixed up words. You will reorder five out of six scrambled words to produce grammatically correct sentences.
- Read a series of passages of text and rate a series of answers related to the passages. These passages reflect a variety of situations commonly experienced (This task is computer-based).
- Complete personality questionnaires about yourself at the end of the session.

➤ Please note that all the above tasks are paper and pen, unless specifically stated otherwise.

Where will our experiment be conducted and how long will it take?

The session will take place in dedicated testing rooms in the main building, Institute of Psychiatry, Kings College (16 De Crespigny Park, SE5 8AF). It will take approximately 1 hour. You will be paid £7 in total to compensate for your time and travel expenses.

What are the benefits of participation?

There are no direct benefits to you. We hope that results of this study will contribute to the understanding and ongoing development of psychologically based theory and therapies.

What are the risks of participation?

There is a very slight chance that you may find some of the words & passages in the tasks or questionnaires upsetting or unpleasant. If you do, the researcher can stop the session immediately, or you can choose to move onto a different item. You also can contact researchers if you feel any upset after the session. Please note you have the right to decline or withdraw from the study at any point without reason or penalty.

Will I get any support?

In case you need any support or help, we provide all those who respond with a list of supportive organizations including useful resources, which refer you to other organizations where you can receive help.

Will my data remain anonymous?

All information you tell us will remain completely confidential within the limits of the law, whether or not you finished the experiment procedures. An identification number will be used to substitute your name on all personal data to ensure anonymity. You may withdraw your data from the project at any time up until it is transcribed for use in the final report.

- It is up to you to decide whether to take part or not. If you decide to take part you are still free to withdraw at any time and without giving a reason.
- If you agree to take part you will be asked whether you are willing to be contacted about participation in future studies. Your participation in this study will not be affected should you choose not to be recontacted.

Thank you for reading this letter. We hope you can participate in this study. Meanwhile, if you have any questions, please feel free to contact me (general queries):

Yuanyuan Huo
Mphil.PhD student
Tel. 020 7848 0512
yuanyuan.huo@kcl.ac.uk

If this study has harmed you in any way you can contact King's College London using the details below for further advice and information.

Dr. Jenny Yiend
Programme Director, Mental Health Studies Programme
Jenny.yiend@kcl.ac.uk

Sources of help, information and support inside the UK

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Tel: 08457 909090, or visit the web site.

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(Rethink were formerly known as the National Schizophrenia Fellowship.)

- **Also see link: <http://www.mentalhealthcare.org.uk/>**

Experiment 5

Participant information sheet for healthy controls



University of London



PARTICIPANT INFORMATION SHEET

Individual Differences in Interpretation Styles

(14/LO/0772)

Please read this for more information regarding participation in our research

Participation is entirely voluntary

Part 1

Invitation

We would like to invite you to participate in this postgraduate research project. You should only participate if you want to; choosing not to take part will not disadvantage you in any way. Before you decide whether you want to take part, it is important for you to understand why the research is being done and what your participation will involve. Please take time to read the following information carefully and discuss it with others if you wish. *Part 1 tells you the purpose of this study and what will happen to you if you decide to take part. Part 2 gives you more detailed information about the conduct of the study.* Ask us if there is anything that is not clear or if you would like more information. If you decide to take part in the study you will be given a copy of this information sheet to keep and will be asked to sign a consent form.

What is the purpose of the study?

The study is part of an educational project conducted at the Institute of Psychiatry by Yuanyuan Huo, Dr. Jenny Yiend, Dr. Sukhi Shergill and Professor Michael Eysenck. We are hoping to learn more about the different ways individuals understand, explain and respond to everyday information. We are also interested in how these processes relate to each other. For example, whether there are strong links between thinking styles and mood. We also hope

our findings from this study may contribute to the establishment of a model of how people process information, and strengthen understanding of variations in thinking style and help therapies more successfully address them.

Why have I been invited?

You are an adult between the ages of 18 and over; speak fluent English; have not been diagnosed with any psychological or psychiatric problem; not currently receiving treatment for any psychological or psychiatric problem; and not taking any psychological or psychiatric medication (this does not include medications for general health concerns). We will be inviting 30 individuals who have had similar experiences to you.

Do I have to take part?

It is up to you to decide whether or not to join the study. We will describe the study and go through this information sheet with you. If you agree to take part, we will then ask you to sign a consent form. You are free to withdraw at any time without reason or penalty.

What will happen to me if I take part?

If you meet the criteria we described and decide to participate, you will be contacted by phone/email for screening. If eligible we may then contact you to invite you to take part in the main study. You are free to decline our invitation.

If you are contacted about taking part you will be asked to participate in the testing session. Even if you agree to participate, you are still free to withdraw at any point during any session. You will meet Yuanyuan Huo (the researcher) for the testing session at the Institute of Psychiatry (16 De Crespigny Park, SE5 8AF). This session will last approximately 1½ hours. You will be asked to read descriptions of situations presented on a computer and answer questions on your reactions to them. You will answer some questions about yourself, complete a series of tasks and complete personality trait questionnaires.

Expenses and payment

Up to £10 will be given to reimburse your expenses.

What will I have to do?

If you decide to take part, you will be asked to:

- You will be asked to complete a range of questionnaires about your thoughts and mood. Most of the questionnaires will require true/false and scale/rating responses to statements concerning your thoughts or mood (such as how you have been feeling over the past two weeks) while some tasks will involve you thinking about past or forth-coming events (such as thinking back to a time when you went to the theatre).
- You will then be asked to complete some computer-based tasks, including (1) We will give you a list of mixed up words (e.g., 'has green child the eyes blue'), and ask you to sort them into a proper sentence

(e.g., 'the child has blue eyes'); (2) We will ask you to read short stories and later, answer some simple questions about them; (3) We will ask you to read a word and a sentence, and decide if the word is related to the sentence (e.g., 'apple'-'Friends invite me to a party', Is the word related in meaning to the sentence?); (4) We will show you lists of words. The words are coloured Inks. We will ask you to say out loud the ink colour of each word (e.g., 'red' if the word is written in red ink).

- After the session, the researcher will spend a few minutes with you, providing a brief outline of the experiment and checking how you found the experience. The researcher will check how the experiment has made you feel and if you have any questions before leaving.

What are the possible disadvantages and risks of taking part?

There is a very slight chance that you may find some of the words & passages in the tasks or questionnaires upsetting or unpleasant. If you do, the researcher can stop the session immediately, or you can choose to move onto a different item. You also can contact researchers if you feel any upset after the session. Please note you have the right to decline or withdraw from the study at any point without reason or penalty.

What are the possible benefits of taking part?

There are no direct benefits to you personally. However, it is hoped that the results of this project will contribute to the understanding and ongoing development of relevant psychologically based theory and therapies. You will be reimbursed your expenses as described above.

What happens when the research study stops?

Data from this study will be reported as part of a doctoral degree undertaken by Yuanyuan Huo. You may withdraw your data from the project at any time up until it is used in the final report in September 2018. At this time you will be offered a lay summary of the study if you request this.

What if there is a problem?

Any complaint about the way you have been dealt with during the study or any possible harm you might suffer will be addressed. The detailed information on this is given in Part 2.

Will my taking part in the study be kept confidential?

Yes. We will follow ethical and legal practice and all information about you will be handled in confidence. Further details are included in Part 2.

If the information in Part 1 has interested you and you are considering participation, please read the additional information in Part 2 before making any decision.

Part 2

What if relevant new information becomes available?

You will be notified immediately in the event this study is stopped for any reason. Arrangements of your continuing care will not be affected.

What will happen if I don't want to carry on with the study?

You are free to withdraw from the study and at any time without reason or penalty. Any data that is not identifiable to the research team may be retained.

What if there is a problem? (Continued from Part 1)

If you have any concern about any aspect of this study, you should ask to speak to the researchers who will do their best to answer your questions (please call Yuanyuan Huo 020 7848 5233 in the first instance). If you remain unhappy and wish to complain formally, NHS Direct (0845 4647) can advise on complaints procedures.

In the event that something does go wrong and you are harmed during the research and this is due to someone's negligence then you may have grounds for a legal action for compensation against the South London and Maudsley NHS Trust, but you may have to pay your legal costs. The normal National Health Service complaints mechanisms will still be available to you (if appropriate). Please note King's College London insurance indemnity will apply.

Will my taking part in this study be kept confidential? (Continued from Part 1)

Everything you tell us will remain completely confidential within the limits of the law.

Anonymity will be ensured by assigning you with a code number. All information provided by you will then be labelled using this number to ensure that sensitive data will not be directly identifiable to you. Code numbers will be stored on a password protected computer. Consent forms and administrative records will be retained in a locked cabinet in the researcher's office. Only members of the research team will have access to personal data and information relating to this study. Please note you have the right to check the accuracy of data held about you and correct any errors. Data will only be used for this study and will be destroyed 7 years after its completion. The only exception is if the researcher believes that there is a risk of severe harm to yourself or others, in which case the researcher will discuss this with you and seek your permission to break confidentiality. In life-threatening emergencies confidentiality may have to be overridden.

What will happen to the results of the research study?

Results from this study are intended to be published. You will not be personally identified in any report or publication. You can request a summary of the results (please check the appropriate box on the consent).

Who has reviewed the study?

All research in the NHS is looked at by an independent group of people called a Research Ethics Committee to protect your interests. This study has been reviewed and given favourable opinion by the Westminster Ethics Committee. The study has also been reviewed by an expert in the methods used to collect the data.

Further information and contact details

If you would like to receive independent information or advice about your rights as research participant you can contact the Patients Advice and Liaison Service (PALS) at SLaM on 0800 7312864. Please use the contact details below if you would like more specific information about this study, advice as to whether you should participate or if you are unhappy with any aspect of the study after you participated:

- Yuanyuan Huo: yuanyuan.huo@kcl.ac.uk or 020 7848 5233

If this study has harmed you in any way you can contact King's College London using the details below for further advice and information.

- Dr. Jenny Yiend: jenny.yiend@kcl.ac.uk or 07977978655

Thank you for considering participating and taking the time to read this sheet.

Participant information sheet for patient (social anxiety)



PARTICIPANT INFORMATION SHEET

Individual Differences in Interpretation Styles

(14/LO/0772)

Please read this for more information regarding participation in our research

Participation is entirely voluntary

Part 1

Invitation

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therapies may be improved and become more effective. We also hope our findings from this study may contribute to the establishment of a model of how people process information, and strengthen understanding of variations in thinking style and help therapies more successfully address them.

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- Yuanyuan Huo: yuanyuan.huo@kcl.ac.uk or 020 7848 5233

If this study has harmed you in any way you can contact King's College London using the details below for further advice and information.

- Dr. Jenny Yiend: jenny.yiend@kcl.ac.uk or 07977978655

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Appendix 7. Consent form

Experiment 1, 3, & 4

CONSENT FORM FOR PARTICIPANTS IN RESEARCH STUDIES

Please complete this form after you have read the Information Sheet and/or listened to an explanation about the research.



Title of Study: Individual Differences in Interpretation Styles

King's College Research Ethics Committee Ref: PNM/10/11-62

Thank you for considering taking part in this research. The person organising the research must explain the project to you before you agree to take part. If you have any questions arising from the Information Sheet or explanation already given to you, please ask the researcher before you decide whether to join in. You will be given a copy of this Consent Form to keep and refer to at any time.

Please tick

- I understand that if I decide at any time during the research that I no longer wish to participate in this project, I can notify the researchers involved and withdraw from it immediately without giving any reason. Furthermore, I understand that I will be able to withdraw my data up to the point of publication. ☐
- I consent to the processing of my personal information for the purposes explained to me. I understand that such information will be handled in accordance with the terms of the Data Protection Act 1998. ☐

Participant's Statement:

I _____

agree that the research project named above has been explained to me to my satisfaction and I agree to take part in the study. I have read both the notes written above and the Information Sheet about the project, and understand what the research study involves.

Signed

Date

Experiment 2

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Experiment 5

Participant consent form for healthy controls



University of London

Participant Identification Number for this trial:

CONSENT FORM Version 2 04/06/2014

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(14/LO/0772)**

Name of Researcher: **Yuanyuan Huo, Dr. Jenny Yiend, Dr. Sukhi Shergill**

- Please initial box
1. I confirm that I have read and understand the information sheet dated 04/06/2014 (Version 2) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐
 2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected. ☐
 3. I agree to take part in the above study ☐

Name of participant

Date

Signature

Name of Person taking consent

Date

Signature

[Optional] Please tick if you'd like to receive a summary of the study findings

I would like to receive a summary of the study findings
Yes

☐

Participant consent form for patients



Institute of Psychiatry

Psychiatry **King's College London and Maudsley** **NHS**
NHS Foundation Trust

University of London

Participant Identification Number for this trial:

CONSENT FORM Version2 04/06/2014

Title of Project: **Individual Differences in Interpretation Styles
(14/LO/0772)**

Name of Researcher: **Yuanyuan Huo, Dr. Jenny Yiend, Dr. Sukhi Shergill**

- | | Please
initial box |
|--|--------------------------|
| 1. I confirm that I have read and understand the information sheet dated 04/06/2014 (version 2) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. | <input type="checkbox"/> |
| 2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected. | <input type="checkbox"/> |
| 3. I agree that my GP will be notified of my participation in this study | <input type="checkbox"/> |
| 4. I agree to take part in the above study | <input type="checkbox"/> |

Name of participant

Date

Signature

Name of Person taking consent

Date

Signature

[Optional] Please tick if you'd like to receive a summary of the study findings

I would like to receive a summary of the study findings
Yes

☐

Appendix 8. Questionnaires

Measures of social anxiety

Fear of Negative Evaluation Scale (FNE) (Watson & Friend, 1969)

Experiment 1

Carefully read each of the 30 statements listed below. Decide whether each statement is true or false **as it pertains to you personally**. If you are unsure which is the better answer, decide which one is slightly more applicable to how you are feeling **AT THE MOMENT** and answer accordingly. Try to answer based on your **first reaction** to the statement. DON'T spend too long on any one item.

(N.B. Please do not rate items according to any experiences you may have had under the influence of drugs.)

Statement	True	False
1. I rarely worry about seeming foolish to others	<input type="checkbox"/>	<input type="checkbox"/>
2. I worry about what people will think of me even when I know it doesn't make any difference	<input type="checkbox"/>	<input type="checkbox"/>
3. I become tense and jittery if I know someone is sizing me up	<input type="checkbox"/>	<input type="checkbox"/>
4. I am unconcerned even if I know people are forming an unfavourable impression of me	<input type="checkbox"/>	<input type="checkbox"/>
5. I feel very upset when I commit some social error	<input type="checkbox"/>	<input type="checkbox"/>
6. The opinions that important people have of me cause me little concern	<input type="checkbox"/>	<input type="checkbox"/>
7. I am often afraid that I may look ridiculous or make a fool of myself.	<input type="checkbox"/>	<input type="checkbox"/>
8. I react very little when other people disapprove of me	<input type="checkbox"/>	<input type="checkbox"/>
9. I am frequently afraid of other people noticing my shortcomings	<input type="checkbox"/>	<input type="checkbox"/>
10. The disapproval of others would have little effect on me	<input type="checkbox"/>	<input type="checkbox"/>
11. If someone is evaluating me I tend to expect the worst	<input type="checkbox"/>	<input type="checkbox"/>
12. I rarely worry about what kind of impression I am making on someone	<input type="checkbox"/>	<input type="checkbox"/>

13. I am afraid that others will not approve of me	<input type="checkbox"/>	<input type="checkbox"/>
14. I am afraid that people will find fault with me	<input type="checkbox"/>	<input type="checkbox"/>
15. Other people's opinions of me do not bother me	<input type="checkbox"/>	<input type="checkbox"/>
16. I am not necessarily upset if I do not please someone	<input type="checkbox"/>	<input type="checkbox"/>
17. When I am talking to someone, I worry about what they may be thinking about me	<input type="checkbox"/>	<input type="checkbox"/>
18. I feel that you can't help making social errors sometimes, so why worry about it	<input type="checkbox"/>	<input type="checkbox"/>
19. I am usually worried about what kind of impression I make	<input type="checkbox"/>	<input type="checkbox"/>
20. I worry a lot about what my superiors think of me	<input type="checkbox"/>	<input type="checkbox"/>
21. If I know someone is judging me, it has little effect on me	<input type="checkbox"/>	<input type="checkbox"/>
22. I worry that others will think I am not worthwhile	<input type="checkbox"/>	<input type="checkbox"/>
23. I worry very little about what others may think of me	<input type="checkbox"/>	<input type="checkbox"/>
24. Sometimes I think I am too concerned with what other people think of me	<input type="checkbox"/>	<input type="checkbox"/>
25. I often worry that I will say or do the wrong things	<input type="checkbox"/>	<input type="checkbox"/>
26. I am often indifferent to the opinions others have of me	<input type="checkbox"/>	<input type="checkbox"/>
27. I am usually confident that others will have a favourable impression of me	<input type="checkbox"/>	<input type="checkbox"/>
28. I often worry that people who are important to me won't think very much of me	<input type="checkbox"/>	<input type="checkbox"/>
29. I brood about the opinions my friends have about me	<input type="checkbox"/>	<input type="checkbox"/>
30. I become tense and jittery if I know I am being judged by my superiors	<input type="checkbox"/>	<input type="checkbox"/>

Social Avoidance and Distress (SADS) Scale (Watson & Friend, 1969)

Experiment 1, 3, & 4

Carefully read each of the 28 statements listed below. Decide whether each statement is true or false **as it pertains to you personally**. If you are unsure which is the better answer, decide which one is slightly more applicable to how you are feeling **AT THE MOMENT** and answer accordingly. Try to answer based on your **first reaction** to the statement. DON'T spend too long on any one item.

(N.B. Please do not rate items according to any experiences you may have had under the influence of drugs.)

Statement	True	False
1. I feel relaxed even in unfamiliar social situations		
2. I try to avoid situations which force me to be very sociable		
3. It is easy for me to relax when I am with strangers		
4. I have no particular desire to avoid people		
5. I often find social occasions upsetting		
6. I usually feel calm and comfortable at social occasions		
7. I am usually at ease when talking to someone of the opposite sex		
8. I try to avoid talking to people unless I know them well		
9. If the chance comes to meet new people, I often take it		
10. I often feel nervous or tense in casual get-togethers in which both sexes are present		
11. I am usually nervous with people unless I know them well		
12. I usually feel relaxed when I am with a group of people		
13. I often want to get away from people		
14. I usually feel uncomfortable when I am in a group of people I don't know		
15. I usually feel relaxed when I meet someone for the first time		
16. Being introduced to people makes me tense and nervous		
17. Even though a room is full of strangers, I may enter it anyway		
18. I would avoid walking up and joining a large group of people		
19. When my superiors want to talk with me, I talk willingly		
20. I often feel on edge when I am with a group of people		
21. I tend to withdraw from people		
22. I don't mind talking to people at parties or social gatherings		

23. I am seldom at ease in a large group of people		
24. I often think up excuses in order to avoid social engagements		
25. I sometimes take the responsibility for introducing people to each other		
26. I try to avoid formal social occasions		
27. I usually go to whatever social engagement I have		
28. I find it easy to relax with other people		

Social Interaction Anxiety Scale (Ayasa-Arriola et al.)

Experiment 1, 2, 3, 4, & 5

No:

Date:

The following questions ask about how you have been feeling over **THE PAST TWO WEEKS**. For each item, please circle the number to indicate the degree to which you feel the statement is characteristic or true for you. The rating scale is as follows:

- 1 = **Not at all** characteristic or true of me
- 2 = **Slightly** characteristic or true of me
- 3 = **Moderately** characteristic or true of me
- 4 = **Very** characteristic or true of me
- 5 = **Extremely** characteristic or true of me

(N.B. Please do not rate items according to any experiences you may have had under the influence of drugs.)

CHARACTERISTIC	NOT AT ALL	SLIGHTLY	MODERATELY	VERY	EXTREMELY
1. I get nervous if I have to speak with someone in authority (teacher, boss).	0	1	2	3	4
2. I have difficulty making eye contact with others.	0	1	2	3	4
3. I become tense if I have to talk about my feelings or myself.	0	1	2	3	4
4. I find it difficult mixing comfortably with the people I work with.	0	1	2	3	4
5. I find it easy to make friends of my own age.	0	1	2	3	4

6. I tense up if I meet an acquaintance in the street.	0	1	2	3	4
7. When mixing socially, I am uncomfortable.	0	1	2	3	4
8. I feel tense if I am alone with just one person.	0	1	2	3	4
9. I am at ease meeting people at parties, etc.	0	1	2	3	4
10. I have difficulty talking with other people.	0	1	2	3	4
11. I find it easy to think of things to talk about.	0	1	2	3	4
12. I worry about expressing myself in case I appear awkward.	0	1	2	3	4
13. I find it difficult to disagree with another's point of view.	0	1	2	3	4
14. I have difficulty talking to attractive persons of the opposite sex.	0	1	2	3	4
15. I find myself worrying that I won't know what to say in social situations.	0	1	2	3	4
16. I am nervous mixing with people I don't know well.	0	1	2	3	4
17. I feel I'll say something embarrassing when talking.	0	1	2	3	4
18. When mixing in a group, I find myself worrying I will be ignored.	0	1	2	3	4
19. I am tense mixing in a group.	0	1	2	3	4
20. I am unsure whether to greet someone I know only slightly.	0	1	2	3	4

Social Phobia Scale (SPS) (Mattick & Clarke, 1998)

Experiment 1, 2, 3, & 4

No:

Date:

The following questions ask about how you have been feeling over **THE PAST TWO WEEKS**. For each item, please circle the number to indicate the degree to which you feel the statement is characteristic or true for you. The rating scale is as follows:

- 0 = **Not at all** characteristic or true of me
- 1 = **Slightly** characteristic or true of me
- 2 = **Moderately** characteristic or true of me
- 3 = **Very** characteristic or true of me
- 4 = **Extremely** characteristic or true of me

(N.B. Please do not rate items according to any experiences you may have had under the influence of drugs.)

CHARACTERISTIC	NOT AT ALL	SLIGHTLY	MODERATELY	VERY	EXTREMELY
1. I become anxious if I have to write in front of other people	0	1	2	3	4
2. I become self-conscious when using public toilets	0	1	2	3	4
3. I can suddenly become aware of my own voice and others listening to me	0	1	2	3	4
4. I get nervous that people are staring at me as I walk down the street	0	1	2	3	4
5. I fear I may blush when I am with others	0	1	2	3	4
6. I feel self-conscious if I have to enter a room where others are already seated	0	1	2	3	4
7. I worry about shaking or trembling when I'm watched by other people	0	1	2	3	4
8. I would get tense if I had to sit facing other people on a bus or a train	0	1	2	3	4
9. I get panicky that others might see me faint or be sick or ill	0	1	2	3	4
10. I would find it difficult to drink something if in a group of people	0	1	2	3	4

11. It would make me feel self-conscious to eat in front of a stranger at a restaurant	0	1	2	3	4
12. I am worried people will think my behaviour odd	0	1	2	3	4
13. I would get tense if I had to carry a tray across a crowded cafeteria	0	1	2	3	4
14. I worry I'll lose control of myself in front of other people	0	1	2	3	4
15. I worry I might do something to attract the attention of other people	0	1	2	3	4
16. When in an elevator, I am tense if people look at me	0	1	2	3	4
17. I can feel conspicuous standing in a line	0	1	2	3	4
18. I can get tense when I speak in front of other people	0	1	2	3	4
19. I worry my head will shake or nod in front of others	0	1	2	3	4
20. I feel awkward and tense if I know people are watching me	0	1	2	3	4

Liebowitz Social Anxiety Scale (LSAS, Liebowitz, 1987)

Experiment 1, 2, 3, 4, & 5

No:

Date:

Please read each situation carefully and answer **two** questions about that situation.

The first question asks how **anxious or fearful** you feel in the situation.

The second question asks how **often** you **avoid** the situation.

If you come across a situation that you ordinarily do not experience, we ask that you **imagine** "what if you were faced with that situation," and then **rate the degree** to which you would fear this hypothetical situation and how often you would tend to avoid it. Please base your ratings on the way that the situations have affected you in **THE LAST WEEK**.

(N.B. Please do not rate items according to any experiences you may have had under the influence of drugs.)

Situation	Fear or Anxiety: 0 = None 1 = Mild 2 = Moderate 3 = Severe	Avoidance: 0 = Never (0%) 1 = Occasionally (1—33%) 2 = Often (33—67%) 3 = Usually (67—100%)
1. Telephoning in public 2. Participating in small groups 3. Eating in public places 4. Drinking with others in public places 5. Talking to people in authority 6. Acting, performing, or giving a talk in front of an audience 7. Going to a party 8. Working while being observed 9. Writing while being observed 10. Calling someone you don't know very well 11. Talking with people you don't know very well 12. Meeting strangers 13. Urinating in a public bathroom 14. Entering a room when others are already seated 15. Being the center of attention 16. Speaking up at a meeting 17. Taking a written test 18. Expressing appropriate disagreement or disapproval to people you don't know very well 19. Looking at people you don't know very well in the eyes		

20. Giving a report to a group		
21. Trying to pick up someone		
22. Returning goods to a store where returns are normally accepted		
23. Giving an average party		
24. Resisting a high pressure sales person		

Measures of paranoia

Green et al. Paranoid Thought Scales (GTPS, Green et al., 2008)

Experiment 1, 2, 3, 4, & 5

Please read each of the statements carefully. They refer to thoughts and feelings you may have had **about others over the LAST MONTH**. Think about **THE LAST MONTH** and indicate the extent of these feelings from **1 (Not at all)** to **5 (Totally)**. Please complete both **Part A** and **Part B**.

(N.B. Please do not rate items according to any experiences you may have had under the influence of drugs.)

Part A.	<i>Not at all</i>	<i>A little</i>	<i>Somewhat</i>	<i>A lot</i>	<i>Totally</i>
1. I spent time thinking about friends gossiping about me	1	2	3	4	5
2. I often heard people referring to me	1	2	3	4	5
3. I have been upset by friends and colleagues judging me critically	1	2	3	4	5
4. People definitely laughed at me behind my back	1	2	3	4	5
5. I have been thinking a lot about people avoiding me	1	2	3	4	5
6. People have been dropping hints for me	1	2	3	4	5
7. I believed that certain people were not what they seemed	1	2	3	4	5
8. People talking about me behind my back upset me	1	2	3	4	5
9. I was convinced that people were singling me out	1	2	3	4	5
10. I was certain that people have followed me	1	2	3	4	5
11. Certain people were hostile towards me personally	1	2	3	4	5
12. People have been checking up on me	1	2	3	4	5
13. I was stressed out by people watching me	1	2	3	4	5
14. I was frustrated by people laughing at me	1	2	3	4	5
15. I was worried by people's undue interest in me	1	2	3	4	5
16. It was hard to stop thinking about people talking about me behind my back	1	2	3	4	5

Part B.	<i>Not at all</i>		<i>Somewhat</i>		<i>Totally</i>
1. Certain individuals have had it in for me	1	2	3	4	5
2. I have definitely been persecuted	1	2	3	4	5
3. People have intended me harm	1	2	3	4	5
4. People wanted me to feel threatened, so they stared at me	1	2	3	4	5
5. I was sure certain people did things in order to annoy me	1	2	3	4	5
6. I was convinced there was a conspiracy against me	1	2	3	4	5
7. I was sure someone wanted to hurt me	1	2	3	4	5
8. I was distressed by people wanting to harm me in some way	1	2	3	4	5
9. I was preoccupied with thoughts of people trying to upset me deliberately	1	2	3	4	5
10. I couldn't stop thinking about people wanting to confuse me	1	2	3	4	5
11. I was distressed by being persecuted	1	2	3	4	5
12. I was annoyed because others wanted to deliberately upset me	1	2	3	4	5
13. The thought that people were persecuting me played on my mind	1	2	3	4	5
14. It was difficult to stop thinking about people wanting to make me feel bad	1	2	3	4	5
15. People have been hostile towards me on purpose	1	2	3	4	5
16. I was angry that someone wanted to hurt me	1	2	3	4	5

Self-report Paranoia Scale (PS, Fenigstein & Vanable, 1992)

Experiment 1, 2, 3, & 4

No:
Date:

The following questions ask about how you have been feeling **OVER THE PAST TWO WEEKS**. For each item, please **circle** the number to indicate the degree to which you feel the statement is characteristic or true for you. The rating scale is as follows:

- 1 = **Not at all** characteristic or true of me
- 2 = **Slightly** characteristic or true of me
- 3 = **Moderately** characteristic or true of me
- 4 = **Very** characteristic or true of me

5 = **Extremely** characteristic or true of me

(N.B. Please do not rate items according to any experiences you may have had under the influence of drugs.)

CHARACTERISTIC	NOT AT ALL	SLIGHTLY	MODERATELY	VERY	EXTREMELY
1. Someone has it in for me.	1	2	3	4	5
2. I sometimes feel as if I'm being followed.	1	2	3	4	5
3. I believe that I have often been punished without cause.	1	2	3	4	5
4. Some people have tried to steal my ideas and take credit for them.	1	2	3	4	5
5. My parents and family find more fault with me than they should.	1	2	3	4	5
6. No one really cares much about what happens to you.	1	2	3	4	5
7. I am sure I get a raw deal from life.	1	2	3	4	5
8. Most people will use somewhat unfair means to gain profit or an advantage; rather than lose it.	1	2	3	4	5
9. I often wonder what hidden reason another person may have for doing something nice for you.	1	2	3	4	5
10. It is safer to trust no one.	1	2	3	4	5
11. I have often felt that strangers were looking at me critically.	1	2	3	4	5
12. Most people make friends because friends are likely to be useful to them.	1	2	3	4	5
13. Someone has been trying to influence my mind.	1	2	3	4	5
14. I am sure I have been talked about behind my back.	1	2	3	4	5
15. Most people inwardly dislike putting themselves out to help other people.	1	2	3	4	5
16. I tend to be on my guard with people who are somewhat more friendly than I expected.	1	2	3	4	5
17. People have said insulting and unkind things about me.	1	2	3	4	5
18. People often disappoint me.	1	2	3	4	5
19. I am bothered by people outside, in cars, in stores, etc. watching me.	1	2	3	4	5
20. I have often found people jealous of my good ideas just because they had not thought of them first.	1	2	3	4	5

Peters Delusions Inventory (PDI; Peters et al., 1999)

Experiment 1, 2, 3, 4, & 5

Participant number _____

This questionnaire is designed to measure beliefs and vivid mental experiences. We believe that they are much more common than has previously been supposed, and that most people have had some such experiences during their lives. Please answer the following questions as honestly as you can. There are no right or wrong answers, and there are no trick questions.

Please note that we are NOT interested in experiences people may have had when under the influence of drugs.

IT IS IMPORTANT THAT YOU ANSWER ALL QUESTIONS.

For the questions you answer YES to, we are interested in:

- (a) how distressing these beliefs or experiences are
- (b) how often you think about them; and
- (c) how true you believe them to be.

On the right hand side of the page we would like you to circle the number which corresponds most closely to how distressing this belief is, how often you think about it, and how much you believe that it is true.

If you answer NO please move on to the next question.

Examples:

Do you ever feel as if people are reading your mind ?

NO YES
(please circle)

Not at all distressing					Very distressing
1	2	3	4	5	
Hardly ever think about it					Think about it all the time
1	2	3	4	5	
Don't believe it's true					Believe it is absolutely true
1	2	3	4	5	

Do you ever feel as if you could read other people's minds ?

NO YES
(please circle)

Not at all distressing					Very distressing
1	2	3	4	5	
Hardly ever think about it					Think about it all the time
1	2	3	4	5	
Don't believe it's true					Believe it is absolutely true
1	2	3	4	5	

1) Do you ever feel as if people seem to drop hints about you or say things with a double meaning ?

NO YES
(please circle)

Not at all distressing					Very distressing
1	2	3	4	5	
Hardly ever think about it					Think about it all the time
1	2	3	4	5	
Don't believe it's true					Believe it is absolutely true
1	2	3	4	5	

2) Do you ever feel as if things in magazines or on TV were written especially for you ?

NO YES
(please circle)

Not at all distressing					Very distressing
1	2	3	4	5	
Hardly ever think about it					Think about it all the time
1	2	3	4	5	
Don't believe it's true					Believe it is absolutely true
1	2	3	4	5	

3) Do you ever feel as if some people are not what they seem to be ?

NO YES
(please circle)

Not at all distressing					Very distressing
1	2	3	4	5	
Hardly ever think about it					Think about it all the time
1	2	3	4	5	
Don't believe it's true					Believe it is absolutely true
1	2	3	4	5	

4) Do you ever feel as if you are being persecuted in some way ?

NO YES
(please circle)

Not at all distressing					Very distressing
1	2	3	4	5	
Hardly ever think about it					Think about it all the time
1	2	3	4	5	
Don't believe it's true					Believe it is absolutely true
1	2	3	4	5	

5) Do you ever feel as if there is a conspiracy against you ?

NO YES
(please circle)

Not at all distressing					Very distressing
1	2	3	4	5	
Hardly ever think about it					Think about it all the time
1	2	3	4	5	
Don't believe it's true					Believe it is absolutely true
1	2	3	4	5	

6) Do you ever feel as if you are, or destined to be someone very important ?

NO YES
(please circle)

Not at all distressing					Very distressing
1	2	3	4	5	
Hardly ever think about it					Think about it all the time
1	2	3	4	5	
Don't believe it's true					Believe it is absolutely true
1	2	3	4	5	

7) Do you ever feel that you are a very special or unusual person ?

NO YES
(please circle)

Not at all distressing					Very distressing
1	2	3	4	5	
Hardly ever think about it					Think about it all the time
1	2	3	4	5	
Don't believe it's true					Believe it is absolutely true
1	2	3	4	5	

8) Do you ever feel that you are especially close to God ?

NO YES
(please circle)

Not at all distressing					Very distressing
1	2	3	4	5	
Hardly ever think about it					Think about it all the time
1	2	3	4	5	
Don't believe it's true					Believe it is absolutely true
1	2	3	4	5	

9) Do you ever think people can communicate telepathically ?

NO YES
(please circle)

Not at all distressing					Very distressing
1	2	3	4	5	
Hardly ever think about it					Think about it all the time
1	2	3	4	5	
Don't believe it's true					Believe it is absolutely true
1	2	3	4	5	

10) Do you ever feel as if electrical devices such as computers can influence the way you think ?

NO YES
(please circle)

Not at all distressing					Very distressing
1	2	3	4	5	
Hardly ever think about it					Think about it all the time
1	2	3	4	5	
Don't believe it's true					Believe it is absolutely true
1	2	3	4	5	

11) Do you ever feel as if you have been chosen by God in some way ?

NO YES
(please circle)

Not at all distressing					Very distressing
1	2	3	4	5	
Hardly ever think about it					Think about it all the time
1	2	3	4	5	
Don't believe it's true					Believe it is absolutely true
1	2	3	4	5	

12) Do you believe in the power of witchcraft, voodoo or the occult ?

NO YES
(please circle)

Not at all distressing					Very distressing
1	2	3	4	5	
Hardly ever think about it					Think about it all the time
1	2	3	4	5	
Don't believe it's true					Believe it is absolutely true
1	2	3	4	5	

13) Are you often worried that your partner may be unfaithful ?

NO YES
(please circle)

Not at all distressing					Very distressing
1	2	3	4	5	
Hardly ever think about it					Think about it all the time
1	2	3	4	5	
Don't believe it's true					Believe it is absolutely true
1	2	3	4	5	

14) Do you ever feel that you have sinned more than the average person ?

NO YES
(please circle)

Not at all distressing					Very distressing
1	2	3	4	5	
Hardly ever think about it					Think about it all the time
1	2	3	4	5	
Don't believe it's true					Believe it is absolutely true
1	2	3	4	5	

15) Do you ever feel that people look at you oddly because of your appearance ?

NO YES
(please circle)

Not at all distressing					Very distressing
1	2	3	4	5	
Hardly ever think about it					Think about it all the time
1	2	3	4	5	
Don't believe it's true					Believe it is absolutely true
1	2	3	4	5	

16) Do you ever feel as if you had no thoughts in your head at all ?

NO YES
(please circle)

Not at all distressing					Very distressing
1	2	3	4	5	
Hardly ever think about it					Think about it all the time
1	2	3	4	5	
Don't believe it's true					Believe it is absolutely true
1	2	3	4	5	

17) Do you ever feel as if the world is about to end ?

NO YES
(please circle)

Not at all distressing					Very distressing
1	2	3	4	5	
Hardly ever think about it					Think about it all the time
1	2	3	4	5	
Don't believe it's true					Believe it is absolutely true
1	2	3	4	5	

18) Do your thoughts ever feel alien to you in some way ?

NO YES
(please circle)

Not at all distressing					Very distressing
1	2	3	4	5	
Hardly ever think about it					Think about it all the time
1	2	3	4	5	
Don't believe it's true					Believe it is absolutely true
1	2	3	4	5	

19) Have your thoughts ever been so vivid that you were worried other people would hear them ?

NO YES
(please circle)

Not at all distressing					Very distressing
1	2	3	4	5	
Hardly ever think about it					Think about it all the time
1	2	3	4	5	
Don't believe it's true					Believe it is absolutely true
1	2	3	4	5	

20) Do you ever feel as if your own thoughts were being echoed back to you ?

NO YES
(please circle)

Not at all distressing					Very distressing
1	2	3	4	5	
Hardly ever think about it					Think about it all the time
1	2	3	4	5	
Don't believe it's true					Believe it is absolutely true
1	2	3	4	5	

21) Do you ever feel as if you are a robot or zombie without a will of your own ?

NO YES
(please circle)

Not at all distressing 1	2	3	4	Very distressing 5
Hardly ever think about it 1	2	3	4	Think about it all the time 5
Don't believe it's true 1	2	3	4	Believe it is absolutely true 5

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